PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

JULY 1957

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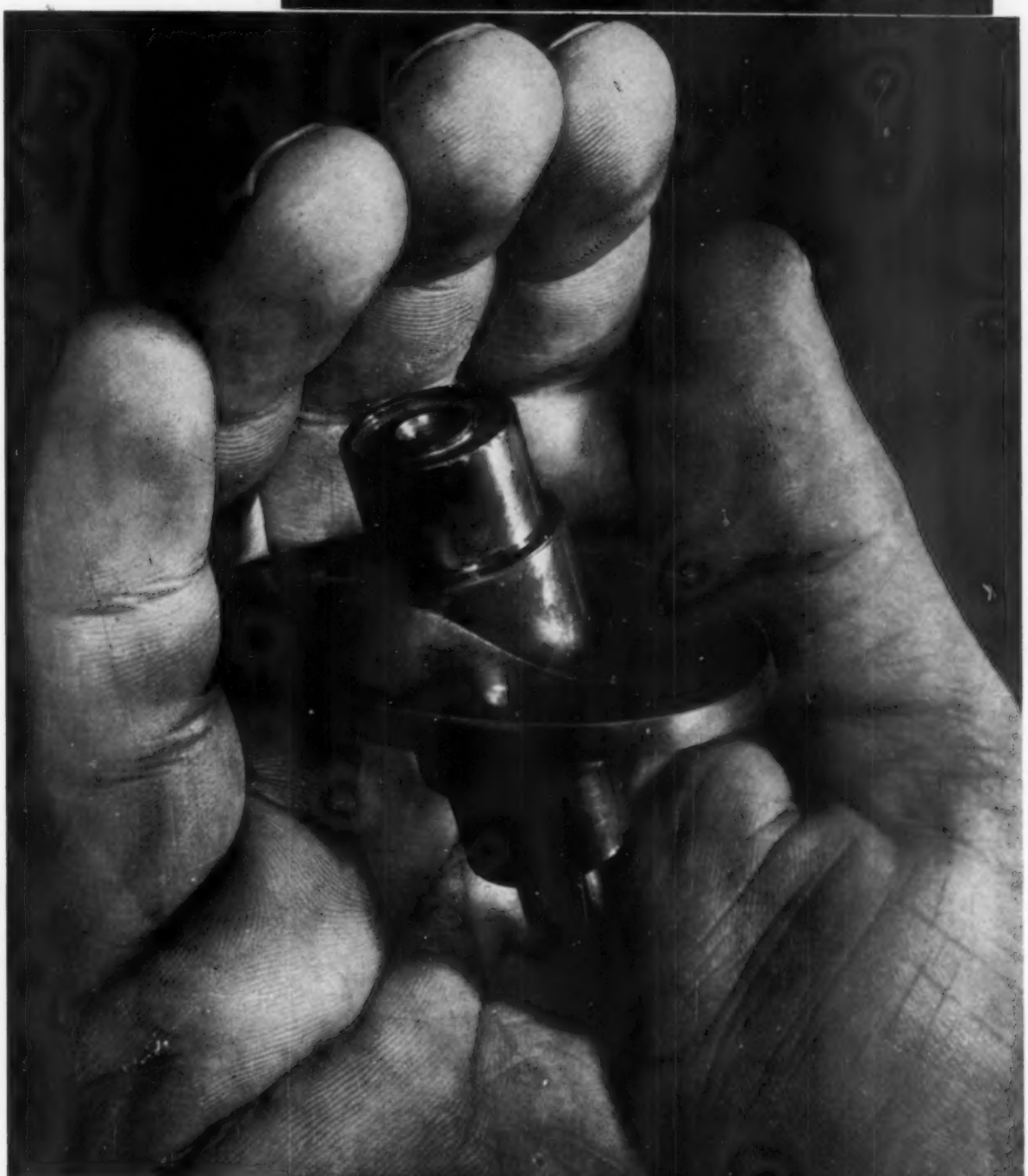

AIRCRAFT FUEL PUMP'S MAIN ROTOR IS MOLDED FROM MOLYBDENUM DISULPHIDE-FILLED NYLON

See Feature Story/page 560

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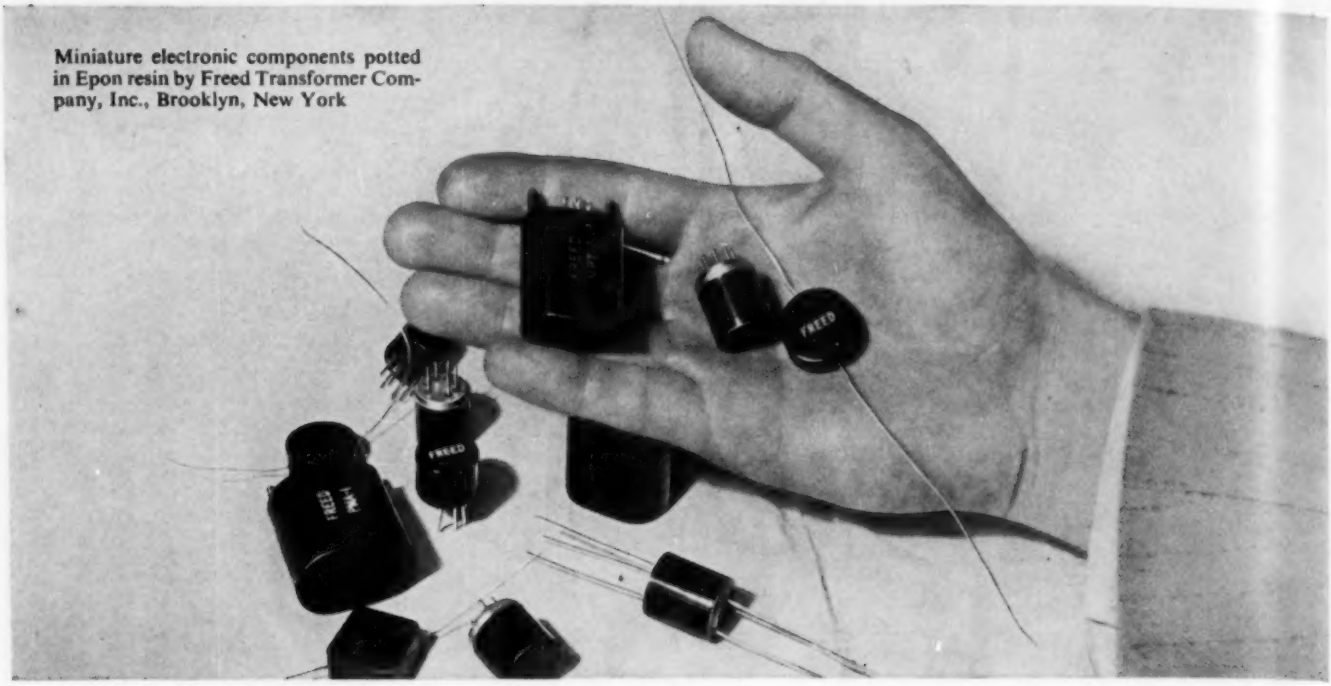

Miniature electronic components potted in Epon resin by Freed Transformer Company, Inc., Brooklyn, New York

Why **EPON®** **RESINS** for potting?

4 Good Reasons!

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2. Excellent dimensional stability
3. High mechanical strength
4. Excellent dielectric properties

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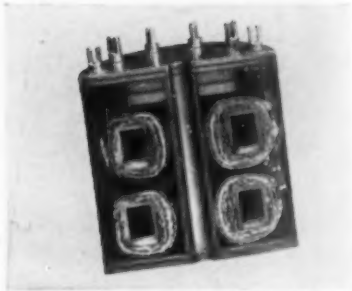
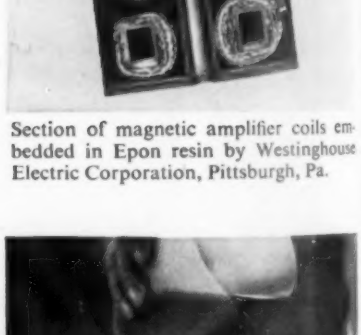
Write for complete information on the use of Epon resins in protective enamels, tool and die materials, etched circuit laminates, transformer and motor sealing compounds.



Section of magnetic amplifier coils embedded in Epon resin by Westinghouse Electric Corporation, Pittsburgh, Pa.



Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, Calif.

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PLASTICS TECHNOLOGY

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JULY 1957 VOLUME III, NUMBER 7

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Article

Highlights

Plastic Compounds Make Molds for Vacuum Forming. (p. 547)

Mold materials are compared and evaluated, and it is found that two epoxy resin compounds free the vacuum former from dependence on a mold maker. Making of the flexible mold and the cast mold are described, along with the advantages of plastic molds.

•

New Methods for Testing Hot Rigidity of Molded Phenolics. (p. 551)

Two test methods are described for determining the hot rigidity of thermosetting parts. Much more accurate than the conventional "squeeze test," they enable the molder to detect subtle differences in closely-rated materials.

•

Polyester Resins from Citric Acid. (p. 555)

Citric acid is esterified first with a glycol, then with allyl alcohol to produce unsaturated polyesters. These can be cured by addition polymerization, without the continued elimination of water.

•

Cutting Plastics with Portable Electric Tools. (p. 557)

Basically, there are three such tools: the circular saw for most thermosetting materials; the jig saw with taper-ground blades for thermoplastics; and the hole-saw attachment for portable drills.

•

Previews

The following articles will be published in the August issue:

Colorants for Plastics. Sevier Bonnie, Jr., Mgr., tech. service dept., Kentucky Color & Chemical Co., Louisville, Ky.

Pressure Measurement in Injection Molding by Use of Ejector Pins. P. D. Kohl, sr. engr., Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Report of an Investigation of the Effect of Various Finishes and Cure Cycle Speeds on Laminate Properties. R. C. Hooper, Research Division, Stamford Laboratories, American Cyanamid Co., Stamford, Conn.

Can Performance Tests Be Developed for Finished Molded Articles? R. A. McCarthy, tech. service rep., Plastics Division, Monsanto Chemical Co., Springfield, Mass.

•

Letters to the Editor

Likes Ferrari Article

Dear Sir:

We wish to extend our congratulations to author Edward Ferrari on his excellent article, "Plastics in New Product Design" (May issue, pg. 376). It is probably the best article on the relatively new field of low-temperature, low-pressure molding processes.

Our only regret is that products such as our high-strength inorganic cement, Versament 177, and rigid latex/catalyst compounds, such as our Versacrete series, were not mentioned.

Many of the techniques described are those that have taken many years to evolve and perfect. We feel that almost all your readers will gain from a careful study of Mr. Ferrari's article.

Richard Versa, Sales Mgr.,
Versa Chemical Co.
New York, N. Y.

• • •

Material for Special Application

Dear Sir:

One of our new projects requires the use of a plastic (preferably thermoplastic) insulator having the characteristics of extremely high volume resistivity, very low dissipation factor, and heat resistance. It is our belief that unplasticized crystal polystyrene material can adequately meet the first two requirements, but is not able to maintain them under the third condition of abnormal temperatures. Possibly some new copolymer or special linkage styrene variation might be suitable, but we have no knowledge of such possibilities.

It would be appreciated if you could suggest possible materials for our application, and all possible primary suppliers of such materials and of the styrenes.

Miss J. M. Dawson
Wong Laboratories
New York, Ohio

(Can our readers offer any helpful suggestions to answer this inquiry?—Editor)

• • •

Heat Sealable Plastic Coating

Dear Sir:

We are seeking a coating to be applied on our cotton fabrics. The coated fabric will be heat-sealed onto a like fabric. Heat sealing should be from 360° F. upwards, for 5-15 seconds. The heat-sealed fabric must stand up under the most vigorous commercial dry-cleaning and laundry washing.

(Identity Withheld)

(Can our readers provide any suggestions to answer this problem?—Editor)

• • •

Styrene Monomer Package Unit

Dear Sir:

I am looking for a package unit to manufacture polystyrene from monomer. I understand that there is such equipment being manufactured in the U. S., but am unable to ascertain the source.

B. J. Danson
B. J. Danson & Associates
Toronto, Ont., Canada

(Suggestions from our readers will be transmitted to the inquirer.—Editor)

• • •

Non-Film Forming Slush Dip

Dear Sir:

Do you know of a non-film forming dip treatment which would prevent the migration of plasticizer from slush cast vinyl objects such as footware? We do not object to a change of color. The main objective is a surface treatment which will eliminate surface tension which we believe is caused by the plasticizer. In other words, the surface must not be water repellent.

J. Walter, Sr., Pres.
John Walter & Sons, Ltd.
Kitchener, Ont., Canada

(Can our readers help?—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, request for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

NEWS in BRIEF

Sales of reinforced plastics are 20-25% ahead of last year, when 140-million pounds were sold, according to Clare E. Bacon, reelected general chairman of the Reinforced Plastics Division, Society of the Plastics Industry, Inc. The main factor cited for this advance is the increased interest in reinforced plastics boats, a field where orders are in excess of productive capacity.

The phenolics molder is underselling his product, depending upon the material supplier to sell applications to the end user. Since this same material supplier is offering a variety of plastic products, he no longer concentrates his promotional efforts on the older material. The molder now must advertise, exchange know-how, and steer clear of price-cutting practices. So says John E. David, general manager of Fiberite Corp. (see guest editorial, page 554).

Development of special coatings for Mylar polyester film has been announced by Du Pont's film department. Commercial production will get under-way later this year at the Circleville, O., plant. The Coated Mylar can be heat-sealed on standard packaging machinery with only minor modifications.

Company developments in the plastics industry saw Union Carbide & Carbon Corp. become Union Carbide Corp. Its division, Carbide & Carbon Chemicals Co., became Union Carbide Chemicals Co. A 50-million pound-per-year plant for the production of fluorocarbons is being built by the aforementioned firm at Institute, W. Va., and should be in operation by mid-1958. Two new techniques for producing vinyl-to-metal laminates have been developed by Arvin Industries, Inc. Minnesota Rubber & Gasket Co., has acquired the assets of General Industrial Products Co., and will operate the firm as Minnesota Latex Rubber Co. A fine-grinding (1-20 microns) service is offered by Sturtevant Mill Co.

Company expansions find Dow Chemical Co. erecting two Styrofoam plants in Ironton, O., and Riverside Mo.; Witco Chemical Co. completing a new plant near Chicago for the production of Fomrez polyesters; United Gasket Co. expanding facilities for extruding both nylon and Teflon; Wyandotte Chemicals Corp. building a new oxide products plant; Wabash Rubber & Plastics Corp. adding an additional 45,000 square feet to its Seymour, Ind., plant; Smooth-On Mfg. Co. doubling its research facilities; Naugatuck Chemical building a Vibrin resin plant in Elmira, Ont.; and Western Plastics Co. doubling its plant size—twice.

New Materials of special interest (see pages 571-3): aerosol mold release; primary plasticizer; seven, colored epoxy hardeners; defoaming agent; ceramoplastic mold material; four, non-ionic surfactants for polyurethanes; and a general-purpose PVC resin.

New Equipment to be noted (see pages 574-6): cartridge heating-elements; an extruder; an injection molding machine; power-operated turret winder for laminates; an electronic micrometer; and two, beside-the-press grinders.

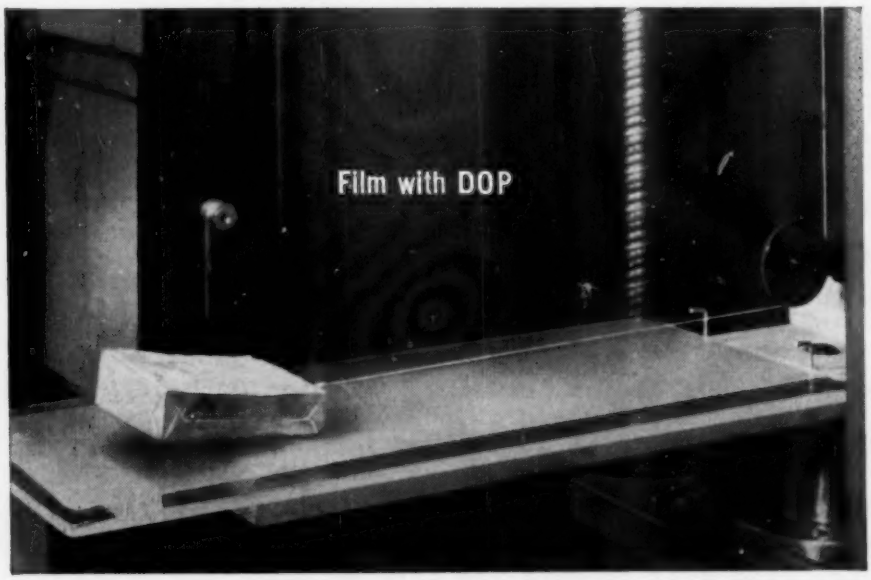
New Products worthy of mention (see pages 577-9): nylon rubbing blocks; polyethylene game ball; nylon-insulated couplings; polyethylene greenhouse; vinyl, three-dimensional sign; reinforced plastic whale; two, pH-measuring units; metallized-plastic extrusions; plastic skin-coating; and phenolic-bonded nylon pads.

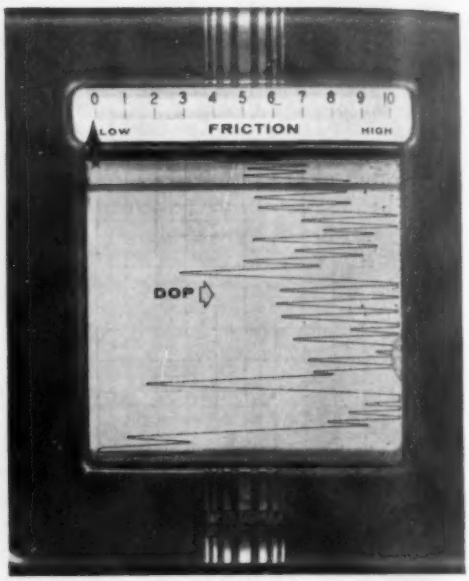
More surface slip for vinyls

Better viscosity/fusion balance

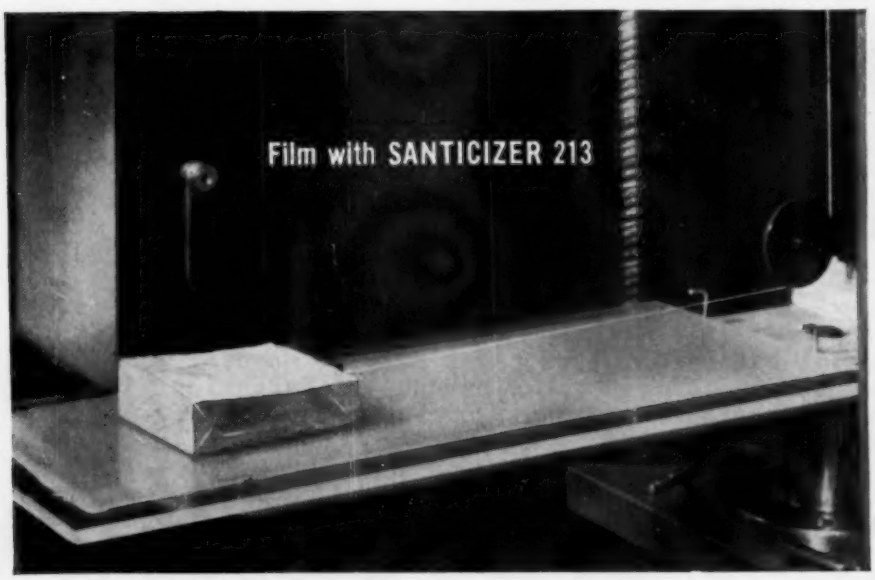
Easy mold release

ONLY SANTICIZER 213 GIVES





PVC film plasticized with DOP sticks to other surfaces.
Santicizer 213 lets PVC film slip across surfaces easily.



1. More surface slip for vinyls

Saniticizer* 213 has the unique ability to reduce the sticking quality of a PVC plastic surface. Instron tester pulling a film-wrapped block shows the greater surface slip imparted to the film plasticized by Santicizer 213. Surface of other film "grabs" and sticks. Coefficient of friction for Santicizer 213 is only about 40% of that for dioctyl phthalate formulations.

PLASTICS TECHNOLOGY

JULY, 1957

THE PASSING OF RAYMOND BILL

In place of our usual editorial, we are using this space for a tribute to our publisher, Mr. Raymond Bill, who recently passed away, and a brief notice of executive changes in our organization to fill the vacancies created by his death.

•

Raymond Bill, 61, president and board chairman of Bill Brothers Publishing Corp., died in his sleep on June 13 at his Greenwich, Conn., home. There had been no previous illness.

After graduation from the University of Wisconsin in 1916, he joined the publishing firm founded by his father, Colonel Edward L. Bill, before the turn of the century. Under his leadership, the organization has become one of the larger and more successful publishers of business magazines.

At the time of his death, he was vice chairman of National Business Publications, Inc.; chairman of Sales Promotion Executives Assn.; and an officer and director of several other publishing companies. He was the prime organizer and first elected president of National Sales Executives, Inc.

In World War I, he enlisted in the Navy and, in subsequent years, served the government in many capacities. He was a former president of the National Conference of Business Paper Editors, former board chairman of Nolde & Horst Co., and for many years a director of RKO Pictures and a suburban bank.

Photo by Pach Bros.

Raymond Bill

Among the publications and organizations

he headed, in addition to this magazine, were *Fast Food, Floor Covering Profits, Grocer-Graphic, Premium Practice, Rubber World, Sales Management, Sales Meetings, Tide, Tires-TBA Merchandising, Yankee Grocer,* and Market Statistics, Inc.

In a very real sense, he was an outstanding pioneer in raising the sights and standards of business paper publishing. Even more important, perhaps, was his ceaseless interest and desire for improvement. His inquiring mind was always receptive to new ideas, new ways of doing old things, experimentation, and daring projects.

Mr. Bill is survived by his wife, a sister, Mrs. Randolph Brown; two daughters, Mrs. Robert Neely and Mrs. John Hartman; and two grandchildren, Lee Martin Bill and Raymond Bill Hartman.

•

PHILIP SALISBURY AND JOHN HARTMAN

ELECTED BOARD CHAIRMAN AND PRESIDENT

Philip Salisbury and John W. Hartman have been elected chairman of the board and president, respectively, to fill the vacancies created by the death of Raymond Bill.

Philip Salisbury joined Ray Bill in 1928, when *Sales Management* was purchased from

Philip Salisbury

the Dartnell Corp., where he was vice president and eastern sales manager. Previously, he had been general sales manager of Ingersoll Watch Co. In his career to date, he has been active in association work in the publishing and marketing fields. He has served on the Bill Brothers Board of Directors for many years. He will continue as editor and publisher of *Sales Management,* and chairman of the executive committee of *Tide.*

John Hartman joined the organization in 1948, after having been a founder-partner and executive vice president of Bacon, Hartman & Vollbrecht, Inc. Previously, he was associated with United Press and Commercial Credit Corp. Before becoming vice president

John Hartman

of Bill Brothers, he served as sales director of *Sales Management.* He has served on the Bill Brothers' board of directors, was first chairman of the Bill Brothers' board of business managers, and is chairman of the company's policy committee. He has been active in numerous business and publishing associations.

Arthur M. Merrill

Editor

PLASTICS
TECHNOLOGY

Plastic Compounds Make Molds for Vacuum Forming

How epoxy resin compounds can replace metals and other materials for vacuum-forming molds.

G. T. MORSE, *Vice President*
Smooth-On Mfg. Co.
Jersey City, N. J.
and
M. S. SCHWARTZ, *President,*
Emet Plastics Corp.
Bronx, N. Y.

FROM its earliest days, the vacuum-forming industry, a relatively new and booming addition to the plastics fabricating field, has been hampered greatly by its rather stringent mold requirements. The molds used in thermoplastic sheet forming processes are positive types against which the heat-softened plastic sheet is drawn by vacuum for the forming process. Production of a satisfactory impression requires a mold with an extremely smooth surface that exactly reproduces the master mold, and is made of a material that can be fabricated quickly, easily, and economically. In addition, the mold must withstand the required operating temperatures, and be strong enough to resist the necessary handling and exposures of long production runs.

Mold Materials

A number of materials have been and are still being used in the manufacture of vacuum-forming molds. As shown in Table 1, none have proved to be entirely satisfactory. Aluminum castings are expensive, take much too long to obtain, and, because of the required hand finishing, lack the precise duplication necessary for mass-production techniques. The vacuum-former must obtain his aluminum castings from an outside source, thus increasing his initial expenses and depriving him of close control over the final mold. Where short runs are involved, these detrimental factors eliminate use of aluminum castings. Sprayed metal molds are even more expensive than cast aluminum molds, and also are ruled out for many applications, even though

Table 1. Comparison of Mold Materials for Vacuum Forming.*

	Aluminum Castings	Sprayed Metal	Wood	Plaster	Phenolic	Metalset Epoxy
Durability	E	VG	G	XP	VG	E
Strength	E	VG	G	XP	G	E
Heat reflectivity	E	VG	P	XP	G	VG
Mold-surface detail	XP	E	G	VG	VG	E
Heat resistance	E	VG	G	P	G	VG
Reproducibility	P	E	XP	E	E	E
Surface finish	E	VG	P	G	VG	E
Repairability	XP	XP	G	G	G	E
Equivalent mold cost	2	1	3	6	5	4
Preparation and finishing time	1	3	2	6	5	4

Abbreviations: E — Excellent; VG — Very good; G — Good; P — Poor; VP — Extremely poor

Numerical ratings: 1 (highest) to 6 (lowest).

*Comparison for average forming applications; would be revised for certain specific applications.

Table 2. Properties of PF-100 Flexible Mold Compound.

Color	Tan
Viscosity, Brookfield, five minutes after mixing	10,000
Tensile strength, psi., after 16 hours	130
After 24 hours	160
Elongation (Scott), %	600
Pot life at 70-90° F., minutes	45
Fill volume of 1 pound, cu. in.	17.5
Shrinkage	Negligible
Specific gravity	1.58

they are satisfactory in other respects.

Wood, plaster, and phenolic molds have many advantages, but their disadvantages are prominent enough to make the vacuum former seek other materials. Wood molds tend to char and lose fidelity after constant usage. Cast phenolic molds are difficult to make, and lack durability. Plaster molds, while relatively easy to cast and suitable for short-production runs, cannot withstand more than about 1,000 impressions. The time and labor involved in casting additional plaster molds and mounting them in the vacuum-forming machine makes this procedure aggravating and uneconomical for long runs. In addition, molds of wood, phenolic, and plaster lack the desirable heat reflectivity of metal.

New plastics have rescued the vacuum forming industry from dependence on outside molders, and given new speed and economy to both long and short production runs. An extremely flexible polymer and a metal-filled epoxy resin allow the vacuum former to produce a mold in his own shop in a few days, instead of the weeks or months formerly required by outside suppliers. Users have described the resultant molds as the first to have the desired durability, economy, ease of handling, and required

Table 3. Properties of Metalset Mold Material.

Uncured mixtures with epoxy resin hardener ZZL 0812*:

Hardener Content, phr	Thickness, Ins.	Exotherm,** °C.	Gel Time, Min.	Hrs. Cure Time***,
4	3	140	40	1
8.2	4	156	30	1½
15	7	90	240	8

Properly-cured casting:

Specific gravity	1.66
Specific volume	16.5
Tensile strength, psi.	6,000
Compress. yield strength, psi.	14,500
Flexural strength, psi.	12,000
Barcol hardness, GYZJ impressor.	88
Linear shrinkage of 1 by 1 by 10-in. bar, in./in.	24
Heat distortion temp. at 264-psi. load, °C.	45-47
Thermal conductivity, Btu./hr./ft./°F./in.	>0.001
Thermal coefficient of expansion, °C.	5.0×10^{-5}

*Product of Bakelite Co.

**Max. temperature at center of casting.

***Time to reach Barcol hardness of 30.

as-cast surface finish.

The two new plastic compounds that have unshackled the vacuum former from dependence on the various mold makers are manufactured by Smooth-On Mfg. Co. The flexible mold compound, called PF-100, (see Table 2) is used to make an exact negative of the original master. Then, the metal-filled epoxy resin compound, Metalset A1 (see Table 3), is poured directly into the flexible mold to produce a metal-like casting that is free from sand and blow holes and has a finish that rivals the most highly polished metal casting. As shown in Table 2, both compounds are cured quickly and easily, are extremely easy to mix, requiring neither power mixers or other specialized equipment, and are relatively inexpensive. The Metalset castings are easily machined for drilling of vacuum holes or later modifications, yet are hard enough to withstand use in the longest runs.

Emet Plastics Corp. is one of the many concerns in this field that has found these new plastics to make a radical difference in their production techniques and schedules. The accompanying photographs show the Emet mold room preparing the vacuum mold for a Paul Jones whiskey display. This mold presented a particular problem because of the required sharpness and high finish of the letters. To do the job satisfactorily in metal, a pressure mold would have been required. Metalset did the job perfectly using a simple and economical procedure that can be followed by any average shopworker having gypsum casting experience.

Making the Flexible Mold

As shown in Figure 1, the liquid components for the flexible mold are first mixed by hand in the properly-weighed proportions, using disposable cardboard containers to eliminate the tiresome cleaning needed by more-permanent containers. After a few minutes of thorough mixing, the PF-100 is poured over the master models made of plaster and sprayed with a parting agent consisting of a 50:50 mixture of kerosene and petroleum jelly (Vaseline). The PF-100 is confined by a simple arrangement of small strips of wood held by plaster. Figure 2 shows the flexible compound being poured into one corner of the master so that the plastic compound flows into the mold area and away from the pouring area, assuring that all spaces will be filled free from air bubbles.

The flexible mold cures by polymerization at room temperature. In its cured state, it is resistant to solvents, oils, and greases, and will withstand intermittent service temperatures to about 200° F. Figure 3 shows separation of the rubber-like negative from the master models. The flexibility of the mold, and the sharpness of the resultant imprint are readily apparent.

An alternate method of making a negative of these masters also can be used if the extreme high fidelity is not required. This method, commonly used in many shops, involves drilling holes in the master, and pulling a shot over it from a plastic sheet. This negative is backed up by pouring plaster over it, and used as the mold into which Metalset is poured to make the final casting. This casting then is cured, drilled, and mounted for placement in the vacuum-molding machine.

George T. Morse was born in Saugerties, N. Y., and received a B.S. in ceramic engineering from Rutgers University in 1924. He joined Woodbridge Ceramic Corp. in 1925 as ceramic engineer, and was sales and development engineer from 1930-1955. In 1955, he came to Smooth-On Mfg. Co. in his present position of vice president in charge of sales. He is a member of Alpha Chi Rho, Keramos (honorary ceramic engineers society), N. J. Ceramic Association, Rutgers Engineering Society, American Ceramic Society, SPE, and the Rutgers Alumni Association. Mr. & Mrs. Morse reside in Metuchen, N. J., and have a son who is an officer in the U. S. Army.

Michael S. Schwartz was born in Catskill, N. Y., in 1926, and attended Jacob Joseph Parochial School, the School of Industrial Art, and Pratt Institute, graduating from the latter in 1944. He saw service with the Navy in 1945. From 1945-1947, he was art director for several advertising agencies and, from 1948-1952, was the proprietor of a small art studio and advertising agency specializing in design of packages and posters. He entered the plastics field in 1952 after becoming aware of vacuum forming, then a new technique, and designed and sold formed plastic packaging to a noted chocolates manufacturer. In 1954, he started the Vacu-Form Corp. of America. He founded Emet Plastics Corp. in 1956, and has served as president of the company since its inception. He is a member of SPI, Permanent Display Producers Association, and Point of Purchase Advertising Institute. Mr. & Mrs. Schwartz have one daughter, and currently reside in Flushing, N. Y.

Fig. 1. Mixing components for PF-100 flexible mold compound.

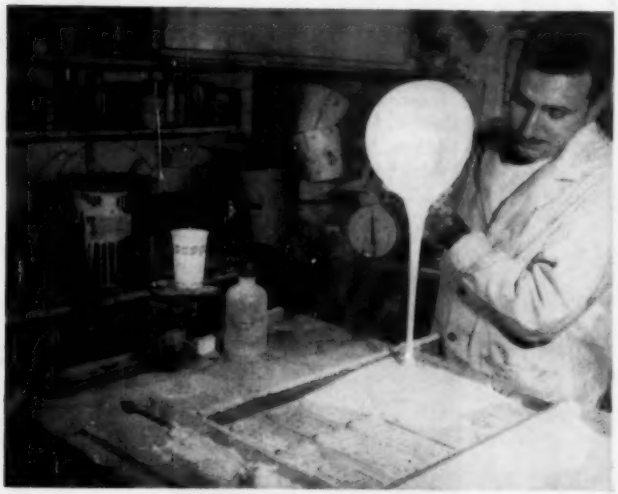


Fig. 2. Pouring mixed PF-100 compound over plaster master.

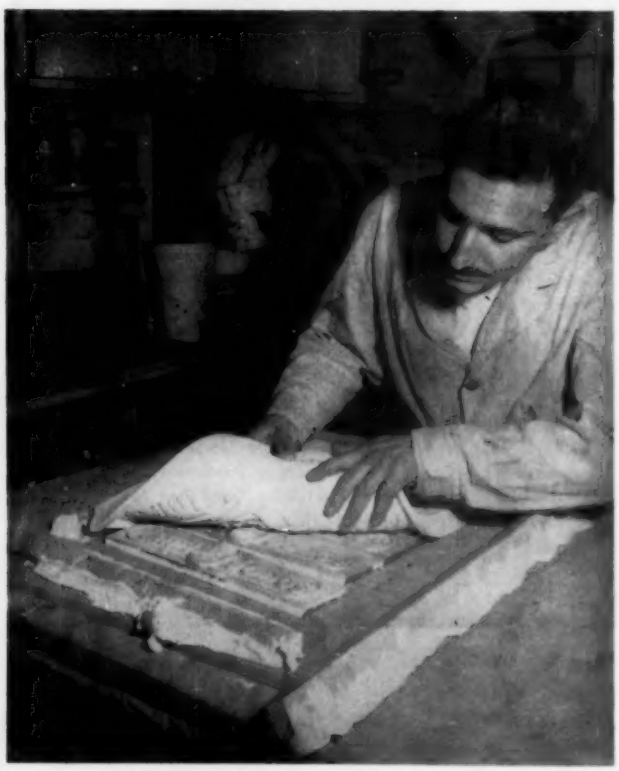


Fig. 3. Cured flexible PF-100 mold being separated from plaster.

Fig. 4. Metalset mix being poured into flexible PF-100 mold. Pins placed in flexible mold form vacuum vents in finished Metalset mold used in vacuum forming.

Fig. 5. Vacuum-formed plastic sheet being removed from Metalset mold.

Fig. 6. Vacuum-formed plastic model cities made with Metalset molds.

(*Continued on page 553*)

H. D. JOST, *Technical Service Engineer, Chemical Materials Department, General Electric Co., Pittsfield, Mass.*

New Methods for Testing Hot Rigidity of Molded Phenolics

Two new test methods are described; one an improvised procedure, the other a more precise method.

HOT rigidity is that property of materials which reduces distortion at ejection, warpage on cooling, and minimizes such problems as knock-out pins pushing through at minimum cure time—all of serious concern to the custom molder. An accurate hot-strength test, therefore, can help the molder predict the behavior of phenolic materials over extended runs.

The value to plastics molders and materials suppliers of the conventional "squeeze test" has been doubted for a long time. It does allow immediate comparison of molded phenolics, but fails to detect subtle differences in closely-rated materials. Molding-room foremen realize that comparison of such materials by the squeeze test can be misleading, because it trusts to memory the comparison of one material to another. Pressroom personnel put on gloves, squeeze or twist the parts as they come from the mold, and make visual observations as to which part is distorted more or less than the other.

Molded parts cool before the squeeze test can be made conclusively. The difficulty in exerting consistent hand-pressures can make attempts at comparison of warped shapes after cooling practically impossible. Despite these obvious and long-recognized shortcomings, the conventional squeeze test does serve the basic need for an immediate, at-the-mold comparison of similar materials.

For those jobs, however, where slight differences in materials can exercise a critical influence on the ability of phenolic parts to satisfy the end-user, General Electric's phenolic products laboratory in Pittsfield, Mass., has developed two hot-strength tests. Designed to standardize test-mold procedures, these techniques provide performance standards measured in mils-deflection.

Improved Test

The first test method is essentially an improvised procedure, which can be used to measure hot-strength of materials in situations requiring immediate comparison. Two blocks of molded phenolic or hard wood, measuring approximately five by five by one-half inches, are clamped together and attached to a bench which

is adjacent to a press molding a standard four by ⅛-inch flash disk. The inside of the block is machined to the contour of the disk, thus forming a slot into which the disk is inserted after molding. Depth of the slot should be one-half the disk diameter, so that only half of the disk is supported while the rest hangs free over the edge of the bench.

Upon ejection from the press, the hot disk is deflashed quickly and placed in the slot. A paper towel or glove should be used to protect the hands. A one-kilogram weight, attached to the end of a a one-foot cord, is suspended from a point approximately one-half inch in from the end of the disk by a pointed hook (see Figure 1).

The mold knock-out pins should be made inoperative to prevent distortion of the part. They will, however, make a slight imprint which serves as a marker for anchoring the hook. A 15-second interval is allowed for removal of the part by spatula and insertion into the slot. The weight is applied for exactly 30 seconds.

Under these conditions, the disk will give or bend at the point of support (see Figure 2). The distorted disk is measured by means of a dial gage. Materials with good hot-strength demonstrate greater resistance to the downward force of the weight, as evidenced by the degree of deflection. Less rigid materials, conversely, will give more under the same force.

More-Precise Test

Although the preceding test represents improvements over the conventional hand-squeeze test, there remain many details open to question. Reliable duplication of results, for example, is difficult. A more precise method has been developed, also by G-E, which provides a quick, accurate test for testing the hot-rigidity of phenolics. Cost of the instrument is approximately $75.00.

The device consists of a metal ring-stand with a ¼-inch ledge or step to hold a four-inch disk. Over this is suspended a one-pound, pointed, metal weight supported on a shaft. This locates the weight at dead center on the disk. A dial gage is attached below the disk, "zeroed" to the bottom of a flat metal disk (see Figure 3).

The test procedure involves the following steps: (1) Mold disks (net weight + 10%); (2) Cure for 45, 60, and 90 seconds; (3) Transfer the disks to the fixture (see Figure 4) exactly 15 seconds after the cure cycle; (4) Apply the load without sudden jar or shock; (5) Allow 30 seconds to elapse; and (6) Record the deflection shown in mils on the gage (see Figure 5).

This test has proven to be accurate, reproducible, and consistent; however, reasonable care must be exercised with the procedure. Correct load weights must be used during molding, since a heavy load can result in thick flash and increased thickness; factors which tend to give a "false strength". Slow mold closing prevents spill-out and excess flashing, which could result in tiny pit marks associated with lack of density. Weight should be applied firmly, but slowly; and the area in which the test is being conducted must be kept reasonably draft-free. Excessive ventilation tends to cool the disk prematurely, thus affecting the true hot-rigidity. Enclosing the entire instrument in a cardboard or wooden housing is recommended.

Test Application

Following is a typical example of the value of this hot rigidity test. Assume an intricate part where some materials or batches of a material work well, while others seem to be "rubbery" upon injection, warp, or

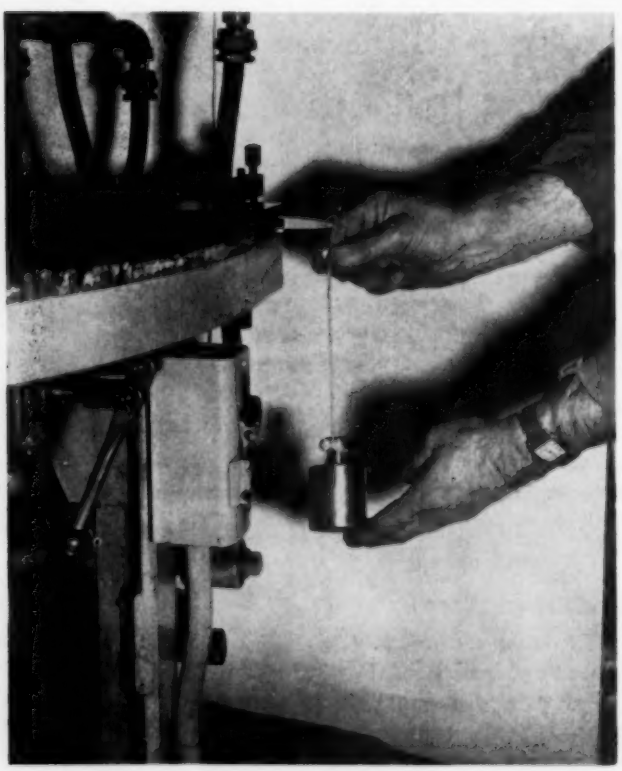


Fig. 1. Weight is suspended from hot, molded disk.

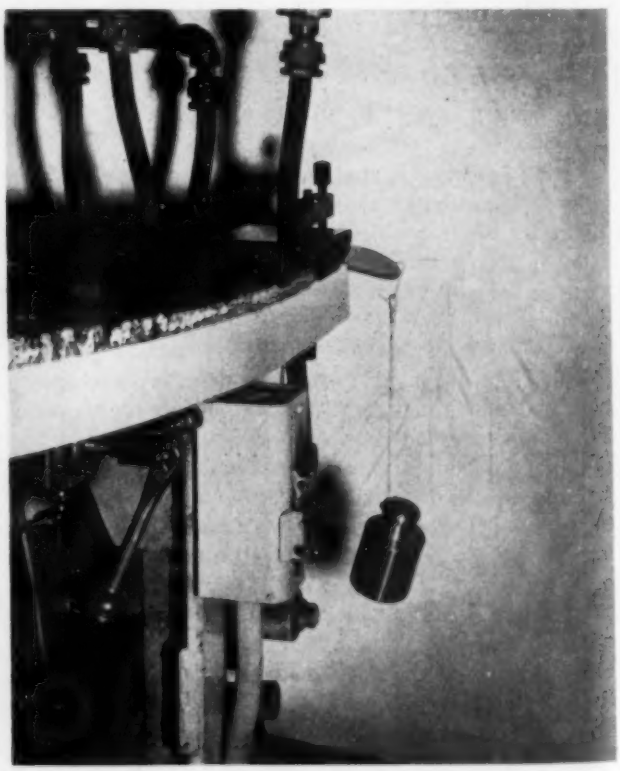


Fig. 2. Weight causes hot disk to distort.

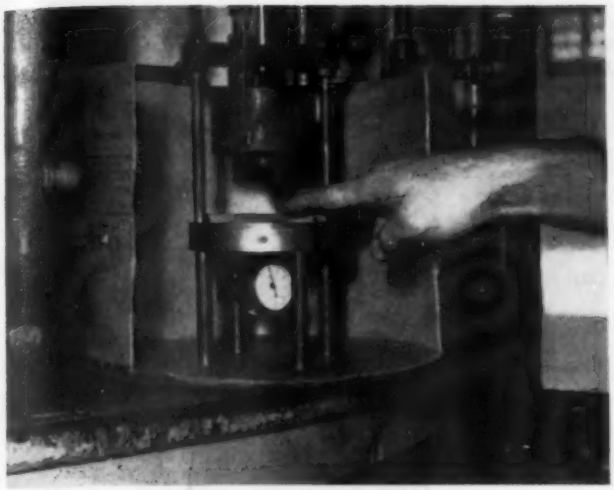


Fig. 3. Dial gage is "zeroed" by the steel bar.

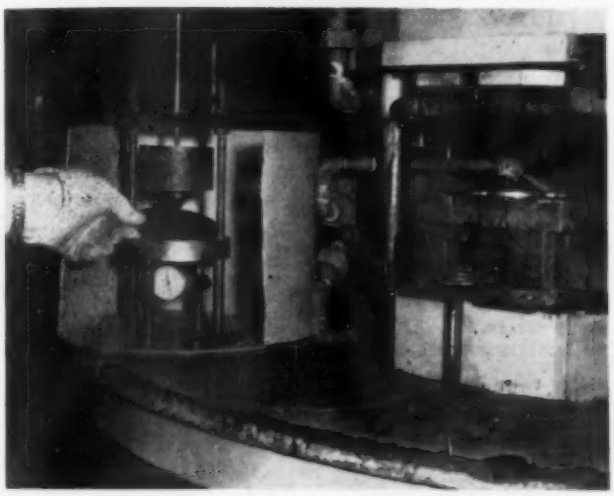


Fig. 4. Hot disk is inserted into testing device.

show evidence of the knock-out pins pushing through the surface. This trouble could be caused by molding conditions; however, let us assume it is caused by lack of hot strength. The test very likely will show the following results.

	Material A	Material B
Comments	Good	No good
Weight used, gms.	52	52
Mils deflection, 45-second cure	135	160
60-second cure	110	145
90-second cure	86	115

It is obvious from the above results that Material A is much stronger while hot than Material B. The former resists the thrust of knock-out pins, whereas the latter permits the pins to push through. The actual readings of Material A could be used as a standard to solve the problem.

The test should serve as an aid in the development of new phenolic compounds. Frequently, special applications demand materials which exceed generally-accepted, industry-wide standards. The hot-rigidity test described above can evaluate experimental trials in short order, thus eliminating bad materials and minimizing testing at the customer's plant. The range of cure times selected for this test was made to show the effects of under-, normal-, and over-cure conditions. There is no reason why these conditions cannot be tailored to suit a particular project. Since hot rigidity, in some cases, is a question of "degree of cure", the test may open up a new method of checking this important characteristic.

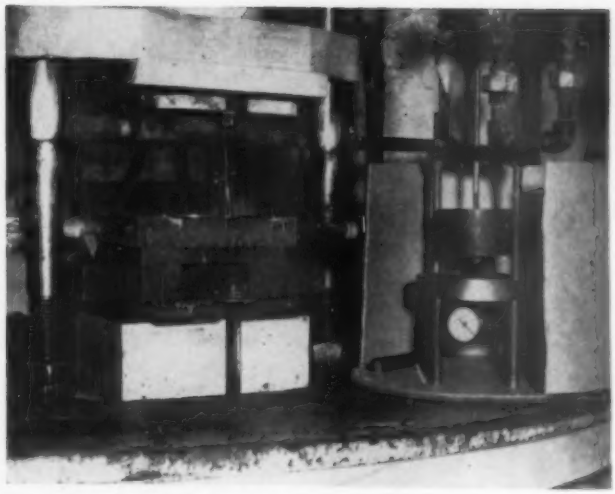


Fig. 5. Mils deflection can be checked after application of weight.

This second test represents a significant contribution to the measurement of the strength of molded phenolic parts as they have the mold—an area of critical importance to both molders and material suppliers.

—THE END

Plastic Compounds Make Molds for Vacuum Forming

(Cont'd. from page 550)

Making the Cast Mold

The Metalset casting compound can be mixed with the same ease as PF-100. The two liquid components, epoxy resin and curing agent, are weighed and mixed in inexpensive cardboard containers. Needles are pushed into the soft PF-100 compound to provide the holes in the final Metalset mold needed for the vacuum process, thus eliminating the arduous drilling process commonly used. Piano wire also can be used for this purpose, or the holes drilled, if preferred. Metalset in its cured state is easily machined. The mold and the needles are sprayed with Vibrin VPA* to assure easy parting of the Metalset casting from the flexible mold.

The Metalset mix is poured, as shown in Figure 4. After initial room-temperature curing during which the casting sets hard and rigid, the mold can be peeled away in the same manner shown in Figure 3. The needles are removed with pliers, and the metallic casting baked in an oven to obtain full cure and optimum physical characteristics. This bake should be done at 150° F. for about 12 hours. The final use of this mold in making vacuum-formed sheet is shown in Figure 5.

*Product of Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn.

(Continued on page 558)

A Time to Sell

JOHN E. DAVID, *General Manager*
The Fiberite Corp., Winona, Minn.

THE recent meeting of the SPI Reinforced Plastics Division in Chicago brought into sharp focus the real results to be obtained by a group of individuals following a progressive sales and promotional campaign. The enthusiasm and optimism of this group is very contagious, and they are to be commended for an excellent meeting. Since our company is in daily touch with the custom and proprietary phenolic molding industry, this meeting presented a new and enlightening viewpoint to us. Probably the most impressive single item at the meeting was the free exchange of information pertaining to materials, methods of molding, methods of processing, and customer problems and relations.

The Reinforced Plastics Industry is growing by such leaps and bounds that it is well for those of us who are associated with the older materials to take a close look at the methods employed by this group to bring about growth and increased sales. Many recent authors, when discussing the polyester industry, have asked the question, "What's all the shouting about?" Without endeavoring to analyze the merits of the materials or applications, the fact remains that the people associated with the reinforced polyesters have done a tremendous job of creating and selling new end-uses for their products.

On the other hand, it appears to me that the phenolics people are guilty of underselling their product. Here is a giant of the plastics industry and, unless one looks at the annual tonnage figures, he will find very little in the way of published information to lead to this conclusion. Since the first phenolics were produced, the major material suppliers have been depended upon to sell applications to the end-user and then, in conjunction with the molder, bring the finished molded items into reality. This approach has left the molders to do very little of their own selling, and made them dependent upon the efforts of the material companies. These material companies, through growth and mergers, now offer such a large variety of plastic products that they are no longer in a position to place the emphasis on selling phenolics that they once did. Our custom and proprietary molders are presently faced with the problem of doing the major part of their own selling, and they find themselves ill-equipped to handle this phase of doing business.

Many phenolic molders are learning that selling end-users on new applications is anything but easy. Through the use of their reputation, research facilities, and engineering personnel, the material companies frequently were able to impress the potential end-user with enough data to overcome his sales resistance. Many of our custom molders, faced with this situation, find that selling end-users on new applications is too difficult, and that it is much easier to go out and underbid their competitors for existing jobs rather than develop and create new ones of their own. This is a serious problem now facing our industry.

The entire phenolic molding business needs new and refreshing applications. To find them, we must sell and promote as we have never sold and promoted before. We must advertise, we must display our new ideas, and we must have a freer exchange of methods and production techniques. Much more work must be done in establishing and giving new meaning to the reputation, dependability, and versatility of our established phenolic molders so that they are not plagued by the price-cutting practices of a few small-overhead operators whose businesses do not require the supporting of a sales and engineering staff.

Furthermore, we must realize that underbidding a competitor for an existing application is not selling. Unless an item is priced unrealistically high, price cutting accomplishes little except to move molds from one plant to another, and to degenerate the general price level. The Reinforced Plastics Industry is showing the way and, to maintain our position, we must accept our selling responsibility on the one hand and refrain from price cutting actions on the other.

—THE END

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and
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Polyester Resins from Citric Acid

Step-wise esterification with glycol and allyl alcohol produces useful polyesters.

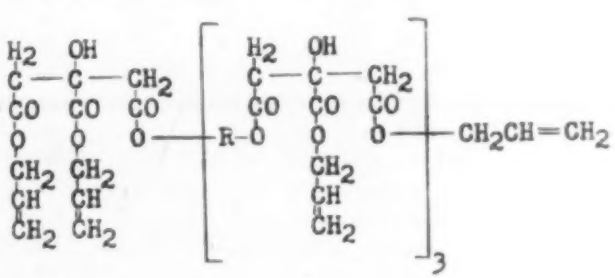
CITRIC acid, a tribasic acid available in highly purified form and at moderate cost, is of potential interest in synthetic resin manufacture. As early as 1856, it was found that heating the acid with glycerine produced a hard, thermosetting mass (1)*. More recently, similar resins with a lower degree of esterification have been suggested for use as adhesives (2,3). Polyhydric alcohols have been prepared by esterifying citric acid with three moles of glycerine (4), or a glycol (5,6), and useful coatings have been reported when these products were baked, either alone or with polybasic acids.

Such condensations generally are not useful for casting or low-pressure laminating owing to the continued elimination of water as a volatile by-product during cure. Unsaturated polyesters, however, can be cured by addition polymerization without this disadvantage; in the laboratory, we prepared such polyesters from citric acid. The desired products can be made by esterification of the acid with allyl alcohol and a glycol. Step-wise esterification, first with the glycol and then with allyl alcohol, was found to be the most satisfactory method.

Esterification Procedure

Proper proportions of citric acid and glycol are necessary in order to avoid the possibility of gelation in the first step. Application of the general approach described by Flory (7) indicates that a molar ratio of glycol to citric acid not exceeding 3:4 is safe, and will not lead to premature gelation.

If four moles of citric acid are esterified with three moles of glycol, six moles of allyl alcohol are required in the second step to complete the esterification. The average product to be expected is as follows:



Where R represents the hydrocarbon portion of the glycol. The actual products, of course, would be ester mixtures of different configurations.

The esterification was conducted with an acid catalyst; the water formed being removed by azeotropic distillation. In most runs, four moles of citric acid were heated under reflux conditions with three moles

Based on a paper presented before the Division of Paint, Plastics, and Printing Ink Chemistry, American Chemical Society, Atlantic City, N.J., Sept. 17, 1956.

*Numbers in parentheses refer to bibliography at end of article.

of a glycol, toluene (25-30% of the total change), and p-toluenesulfonic acid (1.25% of the total charge), until the volume of water indicating complete esterification of the glycol had been collected. At this tage, the reaction mixture consisted of a fluid, toluene-rich layer and a very viscous resinous layer.

Allyl alcohol, 15% in excess of that required for completing esterification of the citrate, then was added, together with 0.01% hydroquinone. Refluxing was resumed under nitrogen, and the reaction mixture soon became homogeneous. When titration of a sample showed the citric acid to be 96-98% esterified, the reaction mixture was neutralized with aqueous sodium bicarbonate. Concentration in a vacuum removed the toluene and unreacted allyl alcohol.

The products were viscous, clear yellow orange syrups. Experiments indicated that color could be improved by substituting phosphoric acid as the catalyst, or by treatment of the ester with activated carbon or sodium hypochlorite.

The polyesters can be cured to hard, transparent products with peroxide catalysts. A commercial paste (Luperco ATC), consisting of 50% benzoyl peroxide in tricresyl phosphate and which dissolves readily in these resins, was used. The gelation time of the resins (measured from time of immersion in a 120° C. bath) is listed in Table 1, along with other physical properties. A 1% benzoyl peroxide concentration was used in the gelation test.

As will be noted, the unmodified citric-acid polyesters have a gelation time of 5-6 minutes. A commercial polyester of the glycol-maleate type containing styrene required four minutes, and a diallyl phthalate prepolymer required 12 minutes. Two of the citrates, resins E and F, have a reduced allyl content; therefore, they have appreciably longer gelation times than do the unmodified citrates.

Citrate polyesters can be copolymerized with vinyl acetate, methyl methacrylate, or triallyl citrate. When reacted with styrene, they form cloudy, incompatible polymers.

Test sheets of the polyesters were cast with 1.5% benzoyl peroxide in a chromium-plated mold. To insure complete cure, a polymerization cycle of 16 hours at 65° C., followed by eight hours at 90° C., was employed. The results of physical tests are given in Table 2.

Test Results

Rockwell hardness values show that the higher molecular weight glycols lead to softer polymers. Replacement of part of the allyl alcohol by butanol produces a similar effect. The resin modified by phthalic anhydride also is less unsaturated; however, hardness and heat-distortion temperature are high. The water absorption, caustic attack, and electrical properties reflect the adverse effect of glycols containing ether linkages, as well as the favorable effect of the phthalate group.

The effect of copolymerization with methyl metha-

(Continued on page 560)

Table 1. Citric Acid Polyesters.

	Resin A	Resin B	Resin C	Resin D	Resin E	Resin F
Glycol employed	ethylene	propylene	diethylene	triethylene	propylene	propylene
Molar proportions:						
Citric acid	4	4	4	4	2	4
Glycol	3	3	3	3	3	3
Allyl alchol	6	6	6	6	4	4
Phthalic anhydride	—	—	—	—	2	—
Butanol	—	—	—	—	—	2
Visc. at 30° C., poises	943	94	176	190	72	62
Refractive index, n_a^{22}		1.486	1.488	1.487	1.510	1.480
Specific gravity	1.26	1.21	1.25	1.23	1.21	1.19
Gelation time, min.	5	6	5	5	8	9

Table 2. Properties of Polymerization Citric Acid Polyesters.

	ASTM TEST METHOD	Resin A	Resin B	Resin C	Resin D	Resin E	Resin F
Glycol employed	—	ethylene	propylene	diethylene	triethylene	propylene	propylene
Modifier	—	—	—	—	—	phthalic anhydride	butanol
Cure shrinkage, Volume %	—	8	8	7	8	7	7
Rockell M hardness	D785-51	112	112	100	81	111	83
Tensile strength, psi	D638-52T	6800	3300	8500	5700	3200	4200
Heat distortion, °F.	D648-45T	153	195	190	109	210	147
Water absorption in 24 hrs., %	D570-42	0.40	0.44	0.57	0.98	0.21	0.57
Caustic attack after 2 days in 10% NaOH*, %		1.8	0.5	12	43	1.6	6.4
Dielectric constant, 60 cps.	D150-47T	4.31	3.98	4.83	5.05	3.80	4.39
Dielectric constant, 10^6 cps.	D150-47T	3.65	3.51	3.92	4.11	3.48	3.60
Power factor, 60 cps.	D150-47T	0.013	0.015	0.022	0.030	0.012	0.030
Power factor, 10^6 cps.	D150-47T	0.025	0.022	0.032	0.041	0.016	0.026

JOHN L. BENNETT, *Manager*
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Towson, Md.

Cutting Plastics With

Portable Electric Tools

The third in a series of articles on current techniques and equipment for cutting and trimming of plastics.

PORTABLE electric tools can be used to cut plastics with excellent results in many cases, although the wide diversification of plastic materials makes it difficult to categorize the best method of sawing each material.

Basically, there are three portable electric cutting tools; the circular saw (see Figure 1), the jig (or sabre) (see Figure 2), and the hole-saw attachment for a portable drill (see Figure 3). A portable electric tool manufacturer, such as Black & Decker, markets several varieties of each of these tools having different capacities, and with a wide assortment of cutting blades for different jobs.

Portable electric circular saws are ideal for making long cuts and for cutting numerous straight lines on a production basis. For straight line cuts, we make a specially-designed saw protractor which can be adjusted to guide the saw at any angle and assures an accurate cut line.

In addition to straight cuts, jig or sabre saws will make all types of irregular cuts in intricate patterns. In the case of the Black & Decker No. 11 Jig Saw, bevel cuts in plastics are possible at angles from 0-45°, up to a maximum depth of 1⅜ inches.

Hole saws permit the cutting of round, straight holes in a material. Powered by a portable electric drill, they can increase the hole-size capacity of the tool many times. Our firm markets more than 30 different sizes of hole saws ranging in diameter from ⅝-4 inches.

In considering the cutting ability of these tools for plastic materials, we can divide the materials into two categories; thermoplastic, and thermosetting. Thermoplastic materials tend to soften when cut, because of heat produced by cutting friction. Thermosetting materials, on the other hand, do not soften with frictional heat, but have a tendency to powder. The following

The first article in this series, published in February, covered panel sawing; the second article, published in June, covered diamond-bonded steel tools.

Fig. 1. Black & Decker 6½-inch saw with planer blade cutting ¼-inch Plexiglas.

general criteria for cutting plastic materials in these two categories are recommended:

(1) Circular Saws. The most efficient cutting for most thermosetting materials is obtained with silicone-carbide abrasive discs. These are not applicable, however, to most thermoplastic materials because of the heat generated. For these materials, crosscut or planer blades are best.

(2) Jig Saws. With thermoplastic materials, we recommend taper-ground fine-tooth blades. The taper grind is important because thermoplastic materials tend to close in behind the saw blades. For thermosetting materials, metal-cutting blades are recommended.

(3) Hole Saws. On thermoplastic materials, lower speed driving unit should be used. For example, with hole saw diameters up to one inch, use 1,700-rpm.

Fig. 2. Black & Decker No. 10 Jig Saw with metal-cutting blade making a pocket cut in ¼-inch thick, masked Plexiglas.

Fig. 3. Black & Decker ¼-inch Utility Drill with hole saw attachment making ⅞-inch holes in Plexiglas disk.

drills; for hole saw diameters from 1-2 inches, use a 600 rpm. drill; and for hole saw diameters greater than two inches, use a 375-rpm. drill. Higher speeds can be used on the thermosetting materials. We would recommend 2,000 rpm. on units up to one-inch diameter; 900 rpm. from 1-1½ inches; 600 rpm. from 1½-2½ inches; and 375 rpm. for hole saws greater than 2½ inches in diameter.

—THE END

Plastic Compounds Make Molds for Vacuum Forming

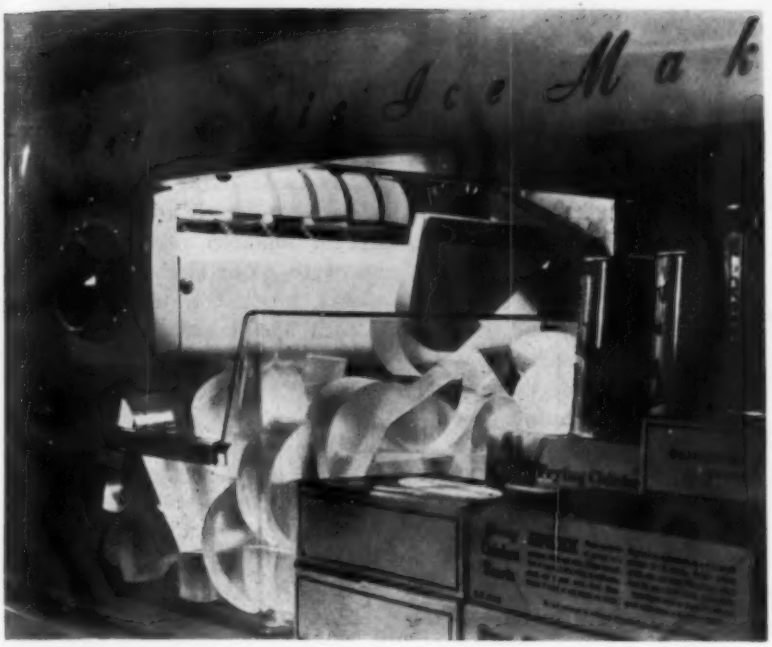
(Cont'd. from page 553)

Another application of this plastic mold system is used to make toy-city formed sheets, as shown in Figure 6. Each of these toy-city molds are 27 by 19½ inches in size and 1½-inch deep.

Advantages of Plastic Molds

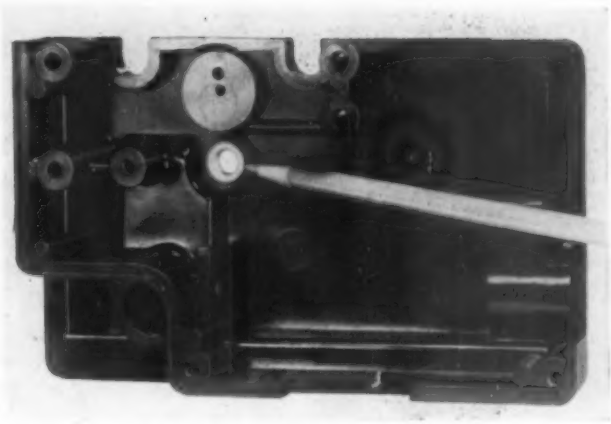
The advantages of the system illustrated are readily apparent to anyone having prior experience with other mold methods. Normally, it will take less time to get an item into actual production using these new plastic materials than it takes to initiate procurement of a cast aluminum or spray-metal mold. The entire mold production procedure becomes an internal matter, and there no longer is any necessity to become involved in the production and planning of an outside supplier. It is this latter factor that has thrown off more vacuum-forming production schedules than any other reason. The vacuum-molder benefits in many ways; he can give much faster and more reliable service to his clients and, at the same time, save money for himself and for them.

—THE END



Close-Up View of the Servel Automatic Ice Maker.

Nylon Bearing for a Phenolic Part



Nylon bearing insert is molded into the Icer's phenolic block.

THE Servel Automatic Ice Maker, first of its kind, freezes ice cubes, stores them in a container, and replenishes them automatically as they are used. A key to its successful operation is the ice-ejecting arm, which sweeps the cubes out of the mold as they are frozen. Removal of cubes from the plastic receptacle reactivates the freezer mechanism, and starts a new cycle.

The ejection arm requires an exceedingly strong bearing that is self lubricating, since oil would contaminate the ice. Block-to-bearing bond must be permanent, even under severe conditions of temperature and use. Nylon was selected as the bearing material because of its combination of properties; however, mechanical assembly was not feasible due to the expense and difficulty of obtaining a lasting bond.

Molding a nylon insert into a phenolic part presents a thorny problem, but Chicago Molded Products Corp., Chicago, Ill., was able to come up with the answer. Given the job of molding the phenolic block for the Automatic Ice Maker, the firm employed a special phenolic formulation and molding technique to incorporate the relatively low-melting nylon bearing into the thermosetting part.

—THE END

Polyster Resins from Citric Acid
(Cont'd. from page 556)

crylate on physical properties is shown in Table 3. Resin C, prepared with diethylene glycol, was used in this instance.

Table 3.
Effect of Copolymerization of Physical Properties.

Methyl methacrylate content, %	0	15	30	45
Cure shrinkage volume, %	7	10	13	14
Rockwell M hardness	100	99	103	102
Tensile strength, psi.	8500	8500	10,100	7400
Heat distortion, °F.	190	179	179	176
Water absorption, %	0.57	0.43	0.31	0.29
Caustic attack, %	12	5.6	1.3	1.0

While hardness, tensile strength, and heat resistance are affected only slightly or not at all, the beneficial effect of methyl methacrylate on caustic resistance is striking. Similar effects were obtained by copolymerizing Resin C with other monomers, including triallyl citrate, vinyl acetate, and dimethyl itaconate. The physical testing was performed exclusively on cast polymers; however, contact-pressure laminates also were prepared from these polyesters with fiberglass cloth.

Several resins were obtained by the simultaneous esterification of citric acid in equimolar proportions with allyl alcohol and a glycol. With this procedure, excessive amounts of allyl alcohol are lost during esterification and must be replaced periodically. The products of these runs were more viscous than those prepared by the two-step procedure, and sometimes remained immiscible with the toluene. No unusual differences were observed in the physical properties of the cured resins obtained by the two esterification procedures.

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—THE END

Filled-Nylon Proves Wear-Resistant

Close-up of main rotor, molded from molybdenum-filled nylon.

UNUSUAL wear resistance, low dry-running friction, superior dimensional stability, and moldability resulted in the selection of Nylatron GS parts for a new series of Ratio-Flo aircraft fuel pumps manufactured by William R. Whittaker Co., Ltd., Los Angeles, Calif. A product of National Polymer Products, Inc., Reading, Pa., Nylatron GS is a molybdenum disulphide-filled nylon which can be used in contact with anodized aluminum.

The filled nylon was used to mold eleven parts of the fuel pump: the main rotor, an O-ring shaft seal, two D-section shuttle seals, a keystone section wear-pad bearing against the shuttle, four roller-shuttle seals, and two shuttle sleeve bearings. Nylatron GS was chosen over unfilled nylon due to its superior molding properties, closer tolerances, and higher wear resistance.

The most important, single component of the pump is the rotor. Nylatron GS is injection molded under high pressures to the perforated, cast-aluminum rotor shaft. Whittaker reports that the material's low coefficient of linear expansion permitted successful molding of the rotor, which would otherwise require machining to required tolerances.

The miniature, positive-displacement pumps are designed to handle aircraft fuels at temperatures from −65° F. to 110° F. Maximum pressure in the pumps is 200 psi; however, experiments show that the molybdenum-filled nylon can be used safely at pressures up to 1,300 psi. Ratio-Flo pumps must be able to run for prolonged periods after a fuel cell is dry. After 100 hours dry run, the filled-nylon parts showed no discernible wear.

The molybdenum disulphide used as the filler in this application is Moly-Sulfide, a product of Climax Molybdenum Co., New York City.

—THE END

Past and Future Developments

For Plastic Film and Sheeting Calenders

E. H. JOHNSON, *Executive Engineer,*
Rubber and Plastics Sales
Farrel-Birmingham Co., Inc., Ansonia, Conn.

WHEN considering the latest developments for any particular design of machine, it is sometimes helpful to review the developments of the past which, while new at the time of initiation or introduction, have become commonplace and accepted as a so-called standard. In other words, the developments become a standard only after proving their value in practice and, insofar as the sales engineer is concerned, only when he does not find it necessary to sell the idea because it is generally accepted by the trade as the best method of accomplishing an end-result.

In terms of life as compared to other industries, the vinyl film and sheeting industry must be considered in the "teen age" class, because it has not reached its twentieth birthday. However, because of its very rapid growth combined with process problems requiring precision end-results, the film and sheeting producer has been responsible in a period of 17 years for more progressive developments in the design of calenders than was the rubber industry in the previous 80-90 years. As a matter of fact, the rubber industry is still hesitant in taking advantage of the many improvements in design which, without doubt, would produce a more accurate calendered product with savings in compound and processing costs.

The writer has been fortunate to have had the privilege of taking part in the design development of the film and sheeting calender from its initiation in 1934. Following, in chronological order, is a list of the major developments which may be of interest to the industry:

1934—18 x 48-inch Four-roll Inverted-L experimental calender.

1940—24 x 60- and 24 x 66-inch Four-roll Inverted-L calenders.

(a) Flood lubrication.
(b) Adjustable bank guides.
(c) Roll surface friction.
(d) Roll honing in the field.

1945—Drilled-type rolls
First Z-type calender, 28 x 78-inch rolls
(a) Preloaded bearings.
(b) Uni-drive and universal connections.
(c) Individual two-speed motor roll adjustments.

1947—28 x 66-inch Z-type calender designed for a speed of 100 yards per minute.

(a) Cross-axis device for deflection compensation.
(b) Hot water circulation for roll temperature control.
(c) Hydraulic gauging roll adjustment for thin film.
(d) Automatic gauging by Beta Ray control.

1950—32 x 92-inch Z-type calender, designed for 150 yards per minute.

(a) Reverse roll contour.

1951—Roll bending by Goodyear Aircraft Co.

1956—First Inclined-Z calender (32 x 86-inch rolls).

(a) Individual motor drive for each roll.
(b) 500° F. roll temperatures.

There are, of course, many minor design developments, such as refinements in bearings and lubrication systems, which are too numerous to mention in detail. However, they are very important for the successful operation of the unit.

From the machinery builder's viewpoint, it is difficult to predict the future as regards the design of this very important machine; however, he does not know that the research chemist is busy developing many new materials with superior qualities which will in time succeed those now in common use. The processor must consider these factors, so as not to be burdened with a calender of obsolete design at the time of purchase. The industry will find the machinery builder willing to cooperate and to redesign to meet his demands for a more versatile unit. The 32 x 86-inch Inclined-Z calender is definitely in this category.

—THE END

PLASTICS TECHNOLOGY ENGINEERING FORUM

Mold Making and Tooling

Edited by:
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Vice President
Eagle Tool & Machine Co., Hillside, N. J.

The terminology of "prehardened steel," as applied to injection molds, is steel that has been heat-treated to somewhere in the range of 30-40 on the Rockwell "C" scale. It is either purchased in this state or heat-treated to this condition prior to the final machining stages of cavity or force construction.

The use of steel in the prehardened condition for large-cavity molds is not new, and has well established its many advantages for this application. In the case of small, multiple-cavity injection molds, however, the idea of using prehardened steel for cavity and force applications has not become popular, as yet. It might be well for us to consider this matter more carefully, since there are many advantages to be gained that may, in a considerable number of cases, outweigh the apparent disadvantages.

Certainly, we cannot deny that a fully-hardened cavity or force will longer resist the effects of abrasion, pounding, peening, and other factors of wear that occur during the molding cycle. This consideration, however, is a relative one, and must be weighed along with the costs of achieving high hardness. Heat treatment involves a certain amount of risk in the operation itself. There are possibilities of cracking, checking, and pitting the metal. Allowances must be made for distortions to the steel in heat treatment, thus increasing the cost of final fitting operations. Heat treating takes time, and this must be considered as a factor in delivery schedules. Mold polishing must be done both prior to and after heat treatment of finished, machined mold parts, thus duplicating some of the polishing efforts.

On the other hand, using prehardened steel involves putting labor into a piece of steel after the risks of heat treating have been passed. Final fit dimensions can be cut directly to size, since further heat-treating distortions no longer need be considered. There is a considerable large saving to be gained where intricate or contoured mold sections are involved. Further, final mold polishing may be carried directly to completion without having to consider the need for extra polishing hours to remove the effect of heat treating.

Many may point out the hazard of easy damage to the relatively softer surfaces of a prehardened mold, as compared to a fully-hardened mold. Let us not lose sight of the more recent advances in injection press design, among them being the feature of low-pressure close.

(*Con't. on page 564*)

Compression and Transfer Molding

Edited by:
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President,
Auburn Button Works, Inc., Auburn, N. Y.

The editor of this column is disappointed by the lack of response to our first attempt at a column which appeared in the March issue. The two editorial requests by Art Merrill for suggestions for future columns also have borne little fruit. I hope that in the next couple of months, you who are vitally interested in the compression and transfer molding industry will put your pet theories in writing and send them either to me or Art Merrill.

The following excerpts are from a very interesting letter received from N. W. Oberle, sales manager of the plastic press division, Baker Brothers, Inc.

I might mention most custom molders lend a deaf ear to all the improvements that have been made in the compression field. While captive molders are listening, moving, and are making tremendous strides, it is certainly awesome and I might go so far as to say fantastic, that some custom molders aren't even aware of the tremendous improvements that have been made in this field. The fact that they are not aware and do not *try* to be aware is the reason a great many custom molders are in the position they are presently in. Namely, not modernizing (1) to protect the business they have, and (2) to procure new business.

Baker has pioneered new heavier-tonnage automatic presses, hydraulic automatic side cores, faster automatics, combination automatic compression-transfer

presses, and many other features. These were developed for the custom molder, because a previous market survey definitely illustrated they are anxious for this type of equipment to obtain lower piece-part prices. Baker undertook the development of these presses and produced them. Subsequently, we attempted, by every device, to sell them to people who wanted them and still need them.

To cite a few examples, in the last

(*Con't. on page 564*)

Reinforced Plastics

Edited by:
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In the last column, I mentioned the pitfalls of deliberate underbidding on the part of reinforced plastics molders in their anxiety to get the contract for "prestige" purposes or other excuses, and the detrimental effects this practice has on the industry. This contributes to many business failures that we read about. Deliberate underbidding lowers quality standards for the manufactured product, hurts the manufacturer's reputation, his potential sales, and hampers the industry's growth.

Both under-and over-estimating also are major problems which plague the industry. Because the industry is still young and many new produces are being pioneered, it is often difficult to get a good estimate on something unseen and untried. A few trial samples may have been produced, but it is not the same as estimating on standard products which have been made for years. Errors can result from inaccurate computations, incorrect analyses, and allied slip-ups caused by carelessness, inexperienced employees, and just plain "guessing" by management.

An estimator should have an engineering background to intelligently understand blueprints, recognize good and bad design details, and know manufacturing processes. The uniqueness of reinforced plastics molding, whether it is accomplished by hand lay-up, contact, compression, pressure, vacuum, or transfer molding makes it important that the estimator possesses reinforced plastics experience. In addition to this, he should accumulate a knowledge of other departmental functions which have a bearing on his estimate, such as plant space available to do the job, purchasing costs, manufacturing, labor schedules, accounting time involved, packing expenses, shipping, and selling expenditures.

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News of the Societies

C. Russell Mahaney

SPI Elects Officers

The Society of the Plastics Industry, Inc., on May 29, elected officers for the two-year period beginning June 1. C. Russell Mahaney, vice president and director of St. Regis Paper Co., was chosen as president and director. He succeeds Norman Anderson, president of General Molded Products, Inc., who was elected chairman of SPI's board of directors.

Newly-elected vice president and director of the Society is R. B. Gutsch, president of aaRBee Plastic Co. He had been serving as chairman of SPI's Pacific Coast Section. William C. Bird, president of Pro-phy-lactic Brush Co.'s Prolon division, has been re-elected secretary-treasurer and director.

The Society has been enlarged to include two new divisions: Cellular Plastics and Plastics Housewares Manufacturers. New directors representing these divisions are Paul G. Roach, of U. S. Rubber Co., and Joseph L. Sholkin, of Beacon Plastics Corp., respectively.

SPE New York Section

More than 100 members and guests attended an April 10 meeting on "Automatic Molding" sponsored by SPE's New York Section. The locale was the Governor Clinton Hotel in New York City, and Saul Blitz, Tico Plastics, Inc., served as moderator.

John A. Kavanagh, Standard Tool Co., spoke on "Small-Size, Hot-Runner Molds," covering the advantages, disadvantages, and limitations of internal manifolds with respect to the molding of small parts. On the positive side, he cited material savings, deeper draws, faster cycles, and homogeneous castings; higher cost was on the debit side.

Glen Bowers, Cambridge Panelyte Molded Plastics Co., discussed "Use of Hot-Runner Blocks in Large Injection Molds." The block was defined as an extension of the heating cylinder, built as an integral part of the mold. Single-sprue, straight injection was found ineffective in the molding of 1,200-square inch parts because the shot failed to fill the cavity. In addition, a clamp pressure of 1,500 tons meant a clamp of about one ton per square inch; insufficient to keep the mold closed. A single-cavity, hot-runner mold with three sprues to the back side of the part was found to be very satisfactory. It offered an advantage over three-plate molding, since there was only one parting line instead of two. One caution is that each sprue must have its own thermocouple.

Frank Bailey, Improved Machinery, Inc., spoke on "Multiple Nozzles," which permit gating directly into the cavity and eliminate sprues. This method could be described as external, hot-runner molding. Gate freezing can be corrected by removing the tip, thus reducing maintenance. The only limitation to the process is the number of cavities (4-6).

Harvey Jensen, A. Schrader's Sons, division of Scoville Mfg. Co., Inc., discussed "Three-Plate Molding," which he felt offered technical advantages rather than reduced costs. The third plate is in the middle, and carries part of the cavities plus the runner system. Three-plate molding is said to minimize flow lines, as opposed to tunnel gating; prevent plugging of the gate; permit better gate design; allow easier changing of gates and runners; and give better separation of the finished part from the runner system.

May 15 Meeting

The May 15 meeting of SPE's New York Section, also held at the Governor Clinton Hotel in New York City, featured a two-part program. About 80 members and guests were in attendance.

"Methylstyrene Molding Compounds" were explained by American Cyanamid's J. A. Melchore, who emphasized the heat-resistant characteristics of these recently-introduced materials. Other features claimed for the materials include improved touchness; chemical, mar, and craze resistance; and ease of molding around metal inserts. Methylstyrene (vinyl toluene) is available as ortho, meta, and para isomers, which can be combined to produce injection molding compounds with varying degrees of heat resistance.

Methylstyrene-acrylonitrile copolymers are obtainable also, and these materials show still better resistance to breakage, marring, crazing, and chemicals. Service temperature for the copolymer averages about 212° F., slightly less than that obtainable with the straight methylstyrene combinations.

"Moving More Merchandise Faster" was the topic of a talk by Joseph Broslaw, Ralf Shockey & Associates, Inc. He felt that "extra mileage" could be gotten out of existing advertising and selling by merchandising informative labeling. A recent survey indicated that informative labeling alone resulted in a retail-sales increase for plastic items in the neighborhood of 5-8%. Key to this success is the retailer, who often is so busy that he cannot take the time to explain the functions and limitations of his merchandise. This, too, is based upon the assumption that he knows the answers.

Retailers are most interested in the possibilities of self-selection. Department stores carry anywhere from 20,000-100,000 items, depending upon the size of the store. Sales clerks, and even the small retailer, simply do not have the time to learn all about these products.

SPE New York Section

More than 100 members and guests attended the June 19 meeting of SPE's New York Section, held at the Governor Clinton Hotel in New York City. Following dinner, two speakers addressed the group.

Jules A. Jupa, Minnesota Mining & Mfg. Co., discussed his firm's recent acquisitions: "Kel-F Thermoplastics and Elastomers". These materials, originally developed by the M. W. Kellogg Co., are members of the fluorocarbon family of products which include dispersions, oils, greases, waxes, acids, and both printing and stripping inks. Kel-F elastomers resulted from cooperative research with the Quartermaster Corps in developing an arctic rubber. Composed of polytrifluorochloroethylene and vinylidene fluoride, the elastomer has a high thermal stability; a water absorption lower than existing rubbers; and is chemically resistant to strong oxidizing acids, mineral acids, peroxide, alkalis, alcohols, aliphatic solvents, hydraulic fluids, and fuming nitric acid in concentrations up to 20-30%. The physical properties of polytrifluorochloroethylene, a Kel-F thermoplastic high polymer, also were described, as well as its behavior during injection, extrusion, compression, and transfer molding.

L. A. Ulmschneider, Eastman Kodak Co., spoke on "Automatic Injection Molding at Kodak Park." Mold design is directed toward the close-tolerance production of film reels and spools. Preference is given to stripper-sleeve types for the automatic removal of flash. A slightly-modified, eight-ounce Reed-Prentice machine, having a 0.028-inch gate dimension, operates at a 16-second cycle to produce 100-foot film reels. Smaller items are molded through gate dimensions as low as 0.018-inch. Using Tenite Butyrate, injection pressures range up to 30,000 psi. Spreader-type heating cylinders with three-inch thick wall sections are used. Heat distribution is such that temperatures do not vary more than 5°. A 25-minute film-tour of Kodak Park's injection molding facilities accompanied the lecture.

Mold Making and Tooling
(*Continued from page 562*)

This feature goes a long way towards protecting all mold surfaces from the usual causes of damage. Whatever force that would damage a prehardened mold surface also would most probably damage the fully-hardened mold, but to a lesser degree. There would still be damage, nevertheless.

Perhaps the most important advantage in using prehardened steels on cavity and force sections is the ease of making changes in these elements after the mold has been run initially. In many present-day injection molding applications, specifically with the polyethylenes, the ultimate shrinkage of the molded parts depends on, and varies greatly, with the molding cycle. Since it is practically impossible to determine the specific cycle in advance, it is equally difficult to calculate the expected part shrinkage. The next best approach, then is to leave steel on the mold where critical dimensions are involved, until the most economical cycle has been established. Then, since the prehardened steel surfaces are easily workable, the important mold dimension can be brought into tolerance on the basis of actual shrinkage dimensions, rather than calculated shrinkages.

—THE END

Compression and Transfer Molding
(*Continued from page 562*)

two to three years alone, of the tremendous improvements that have been made in this field.

Several of the material suppliers have brought out faster-curing materials. These came about because faster cycling presses have been developed. Previous to this, there wasn't sufficient reason to justify the cost of experimenting and producing these materials, as the available equipment had not kept pace and had, in fact, impeded material improvement.

(1) Automatic granulations have been produced.

(2) A new polyester powder has been developed.

(3) Preheaters have been developed for automatically feeding preheated powder. This method, of course, eliminates a preform press and the labor at the preform press . . . the labor to move preforms to preheaters—the labor to remove the preform to the press.

(4) As to presses, Baker has pioneered faster-traversing presses of 400 inches per minute, permitting faster cycles and making room for material improvements and preheater improvements—all to provide faster cycles in the compression field and permitting subsequent "lower piece-part prices."

(5) Heavier tonnage automatics of 100-, 150-, and 175-ton capacity; all having high traverse rate, the flexibility to be coupled with high-frequency preheaters, and adaptability to handle faster curing materials. Above all, to allow larger and larger parts to be molded automatically. Again, to permit lower piece-part prices, the obstacle that all of us are continually fighting. Now, parts over eight inches in diameter are presently being automatically molded on these presses. Also parts of over six inches draw are presently being automatically molded on these presses.

(6) Hydraulic side-core attachment sequenced into the press panel; again, providing new equipment to mold parts automatically that never could be produced that way before, and to eliminate labor cost.

(7) Our company's latest is a combination press. This is an automatic compression and transfer press. Here, again, we tend to offer the ultimate in flexibility for the custom molder. Instead of investing in an automatic compression press and in a transfer press and having each one idle part of the time, he could purchase a Baker combination. He can operate automatic, compression, change mold to transfer, switch a button from automatic compression to transfer and go into transfer molding, all on the same press.

We ourselves have had the experience of providing new automatic compression presses to take jobs away from transfer molding. Big cost savings are possible, via the elimination of labor, so many companies are taking parts that were previously molded by transfer and changing them to automatic compression because these new automatic presses are now of sufficient tonnage to handle these jobs. This trend of cost savings will keep parts in the compression field. If this is not done, obviously, many will continue to be changed to thermoplastics. Even many parts that have inserts either are being considered for automatic insert loading, or else the part is automatically molded and the pin or pins inserted afterward as a secondary operation. The point, again, is with the advent of these new presses, new materials and new methods, the progressive companies are carefully scrutinizing all parts for cost reductions, determining methods for this via the new equipment that is available and . . . making them.

It is granted this field lay fairly dormant as far as progress is concerned for many years, while the injection manufacturers and the thermoplastic manufacturers leaped ahead. Now that progress is again apparent in this field, it behooves all to be aware of it. We might add that some parts that went to thermoplastic during its big surge already are being deeply considered and recosted for automatic compression.

Unfortunately for the custom molder, but fortunately for Baker, these presses are moving in ever increasing quantities. The captive molder is buying the equipment designed for the custom molder, because he realized the potential that can be obtained with this automatic equipment.

Obviously, if all the fine new equipment in the injection field had been developed and not purchased, there would never have been the surge in that field that has taken place.

Proof of the above is the fact that we are turning out these new automatics in continually-greater quantities. Over 95% of all our customers, however, are the so called "blue-chip" companies (captive molders).

It is true that, in recent years, some companies have expanded at a very fast rate in the injection field. It is also true that many captive operations have expanded rapidly in the last two years in the compression field. These latter are basically captive, because the custom molder refuses to move on all of the above-listed improvements. The captive companies obtain piece-part quotes from the custom molders on his manual equipment versus preliminary molding cost studies on his parts molded on Baker automatics. Obviously, the cost differential is tremendous; consequently, he can show justification to go into the molding operation and pay off the high cost of an automatic in one or two years. The above is not theoretical, but actual. Evidence is that we are selling companies that never molded before, and companies that previously farmed-out a great deal of their molded parts business. Most companies are continually analyzing their cost per part, and will not pay exhorbitant costs that can be substantially reduced. Again let me repeat, if the custom molder would modernize his compression department as, in most cases, he has his injection department, I am sure his compression picture would be on the upgrade, rather than the downgrade.

—THE END

Reinforced Plastics
(*Continued from page 562*)

He also should be aware of the latest developments in resin, fiber glass materials (or other reinforcement agents), various catalysts, surfacing materials, chemical and physical properties of materials, and the market potentials of the finished product. From such a conglomeration of facts, he can proceed with his estimate.

Because of the human element involved, no two estimators can arrive at exactly the same figure. At best, management can assume that a checked and re-checked estimate will have to stand "as is" if they are satisfied with the way they arrive at the figure.

At Lunn, we believe we have a good system for estimating on a proposed project. After a conference at which management is convinced that the suggested product be made of reinforced plastics, another meeting is held by department heads to determine the best method of fabrication.

Depending on the type of product and the quantity to be produced, the required plant space to be allotted to the item is discussed. One small job may offer a lower profit but utilizes less plant space whereas a larger article offering a bigger profit is costly in plant area. All these factors must be weighed carefully by the estimator.

Availability of labor, both present and future, is an important part of the proposed estimate. In this respect, we have a Control Board which shows at a glance the various assignments in the plant, the availability of labor for weeks to come, and planning of work schedules into the immediate future. The Individual Job Man-

(*Continued on page 570*)

News of the Industry

Wyandotte Builds Oxide Plant

Wyandotte Chemicals Corp.'s new oxide products plant at Wyandotte, Mich., should be ready for occupancy late this year, according to company sources. Capable of producing millions of pounds of chemicals annually, the multi-purpose facility has been designed for future expansion plans.

Among the products scheduled for increased production are the Pluronic and Tetronic polyols, the firm's polyethers which are used as non-ionic surfactants and as polyurethane intermediates. Already field-tested, these materials are reported to improve product life and lower the manufacturing costs of polyurethane foams.

The new plant is the latest in a series of expansion projects. A $30-million plant was completed late last year near Baton Rouge, La., and now is producing ethylene oxide, chlorine, and caustic soda. Other Wyandotte units are located in Los Nietos, Calif., Calvert, Kan., and Blue Mountain, Miss.

Announces Expansion Plans

Minnesota Rubber & Gasket Co., Minneapolis, Minn., has acquired the assets of General Industrial Products Co., Inc., and will operate the firm as a manufacturing division. Walter Craig, president of Industrial Products, will continue as general manager of the new division, which will be known as Minnesota Latex Rubber Co.

The new division will include the original company's two plants in Minneapolis, plus a new plant adjacent to present facilities. Sales and administrative offices will be located at the parent firm's headquarters. Production of sprayed, dipped, and formed rubber parts will be continued, in addition to further development of the Kotokast process. The latter is a rubber- and plastic- forming method for industrial and commercial parts.

Packaged Produce Gains Favor

The pinch, poke, and peel customer is a vanishing breed, according to a recent Du Pont Survey. Over 52% of the 2,000 housewives polled preferred packaged produce, with a mere 25% preferring the bulk display. All patronized stores which offered at least half of the produce in packaged form.

As evidence of this changing attitude, a 1950 survey found 49.5% of the customers preferring loose produce. Transparent packaging preserves the right to inspect, according to Du Pont spokesmen, but complete confidence in packaged goods will result only when the customer is convinced the items are similar in quality and variety to those in a bulk display.

Among the reasons given for the switch to packaged goods are convenience, time savings, sanitation, and preservation of freshness. The items purchased most frequently in plastic packaging include apples, oranges, carrots, lettuce, onions, potatoes, and tomatoes.

UCC Announces Name Change

Effective May 1, Union Carbide & Carbon Corp. became Union Carbide Corp. At the same time, the names of three of the corporation's divisions were changed as follows: Linde Air Products Co. became Linde Co.; Carbide & Carbon Chemicals Co. became Union Carbide Chemicals Co.; and Carbide & Carbon Realty Co. became Union Carbide Realty Co.

To Expand Wabash Plant

An additional 45,000 square feet of production and warehouse space is being added by Wabash Rubber & Plastics Corp. to its existing 15,000-square foot plant at Seymour, Ind. The ground already has been broken, and building is under way. The new addition will increase production by more than 100%. Current output now is in excess of $1-million per year. Additional machinery will be installed, and it is anticipated that 200 workers will be added to the production force before the end of the year. The company, a subsidiary of the H. O. Canfield Co., uses plastics, rubber, silicones, and other synthetics in its many operations.

Canadian Polyester Plant

The first Canadian firm to manufacture polyester resins, Naugatuck Chemicals, division of Dominion Rubber Co., Ltd., has commenced construction of a Vibrin polyester plant in Elmira, Ont. Opening date has been set tentatively for the end of the year, and the three-story structure is expected to cost over $500-thousand.

A variety of basic polyester resins will be produced, as well as pre-mix compounds and alkyds for polyurethane compounding. Annual capacity will be several million pounds. Naugatuck is in the process of completing a development and control laboratory at the same location.

Develops Coated Mylar Film

The development of special coatings for Mylar polyester film has been announced by the film department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Commercial production will get under-way later this year at the Circleville, O., plant.

Tests show that coated Mylar can be heat-sealed successfully on standard, high-speed, automatic packaging machinery with only minor modifications. Regular Mylar is sealed with adhesives, or with a combination of heat and a solvent. Increased impermeability to moisture and gases also is reported for the coated film, and commercial tests of candy and cookie packages have proved successful.

Doubles Plant Size—Twice

Increased demand for Klearcor polyethylene pipe has made it necessary for Western Plastics Corp., Hastings, Neb., to double its original plant capacity in 1956, and again in 1957. Organized in 1954, the firm has more than doubled its production capacity.

Klearcor pipe utilizes a clear, unpigmented, virgin polyethylene core with an outer jacket of black polyethylene. Jacket and core are processed simultaneously to eliminate any possibility of separation. Western Plastics also manufactures a Kralastic Drop Pipe for rigid applications.

Enters Fluorocarbons Field

Plans for entering the fluorocarbon field have been announced by Carbide & Carbon Chemicals Co. A 50-million pound-per-year unit will be built at the Institute, W, Va., plant, and should be in operation by the latter half of 1958.

With Carbide's production, the total U. S. capacity for these materials will exceed 300-million pounds yearly. Another division of Union Carbide & Carbon Corp., Bakelite Co., already has developed several fluorothane resins.

Doubles Research Facilities

The plastic research facilities of Smooth-On Mfg. Co. will be doubled, with the Spring completion of additional units to the Jersey City, N. J., plant. Smooth-On's plastics division has developed a number of epoxy and flexible-plastic products for use in the metal-working, electronic potting and encapsulation welding, and ceramics fields.

Uses Plastics Extensively

Nowhere have plastics been used more extensively as construction materials than in the new research center of Monsanto Chemical Co.'s inorganic chemicals division. Located in Creve Coeur, near St. Louis, Mo., the laboratory is a three-story structure occupying about 70,000 square feet of floor space. It contains 40 laboratory modules, a chemical research section, offices, library, and service facilities for 160 chemists and technicians.

From the nearly 100% plastic exterior throughout the building, plastics are used in more than 80 different applications. Among the newer uses of plastics are reinforced polyester- and foamed styrene-sandwich wall panels, Teraise plastic wall covering, polyester-faced concrete blocks, urethane paint, polyester exhaust fans and control dampers, laminated polyester and urethane foam structural supports, vinyl foam insulation, phenolic-impregnated honeycomb panels faced with polyesters, styrene wall tile, polyester vent stacks and molded drawers, acrylic windows, and impact styrene lab partitions.

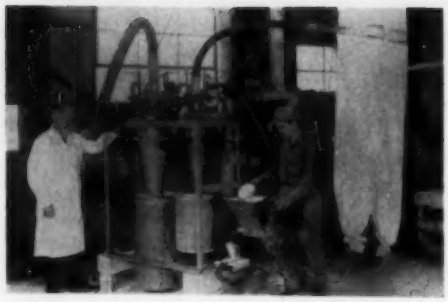
Monsanto, one of the nation's largest producers of plastics raw materials, wanted to demonstrate the many applications of plastics within the framework of conventional building practices and existing data. No attempts were made to incorporate the new design concepts developed in conjunction with the "House of the Future."

Plastics played a major role in the construction of Monsanto's inorganic chemicals laboratory, shown in the above photograph.

Witco Completes Fomrez Plant

Completion of a new plant at the Emulsol Chemical division's Chicago site has been announced by the parent firm, Witco Chemical Co. The new facility should more than double the company's capacity for producing Fomrez, polyesters used in the manufacture of flexible urethane foams.

The plant is equipped with completely automatic controls, backed by strict laboratory control. Witco will not produce the actual foams, but will specialize in the preparation of their chemical constituents. Included among these are Fomrez 50 and Witco 77-86, the latter being a coupler which imparts uniformity to the foams. Future plans call for the production of raw materials for rigid urethanes as well as a hydrophilic polyester.



Material is fed into an eight-inch Micronizer.

Offers Fine-Grinding Service

Sturtevant Mill Co., Boston, Mass., has opened a Micronizer pilot plant for the experimental and custom grinding of materials to sizes ranging from 20 microns to smaller than one micron. Experimental grinding will be offered at the cost of set-up and labor, and custom grinding bids will be offered upon request.

Sturtevant has four fluid-energy mills now in operation; three operating by compressed air, and one by steam. They have no moving parts, but operate on the principle of high-speed rotation of particles by jets of compressed air or steam. This causes violent impact of the particles, tending to pulverize them without inducing attritional heat.

Materials are introduced into the chamber through an opening near the periphery. The feed rate and/or the volume and pressure of the grinding medium (compressed air or steam) can be adjusted to effect changes in ultimate particle size. Centrifugal force keeps the coarse particles in the bombardment zone until they are sufficiently fine to move inwardly to the point of discharge.

Major use for the Micronizers is the simultaneous dry grinding and classification of superfine solids to a degree impossible by other commercial machines. Sturtevant engineers eight sizes of the basic unit, ranging from the two-inch lab mill to the 36-inch grinding chambers.

Opens Two Styrofoam Plants

Two new plants have been opened by Dow Chemical Co., both devoted to the production of Styrofoam. Situated in Riverside, Mo., and Ironton, O., the facilities double Dow's productive capacity for this rigid, foamed styrene material. The company has similar units at Allyn's Point, Conn., Torrance, Calif., and Midland, Mich.

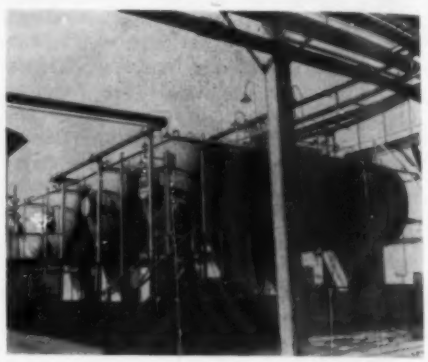
Expands Extrusion Facilities

Facilities for extruding both nylon and Teflon are being expanded by United States Gasket Co., Camden, N. J. The plastics division of Garlock Packing Co., U. S. Gasket is spending $300,000 on new extruders which will widen the range of sizes available in nylon rods, tubing, and special shapes.

The firm has purchased ten, newly-designed, high-speed extruders for Teflon, and has added an additional 20,000 square feet of floor space to accommodate the added equipment.

Cellular Glass Insulation

Foamglas insulation, a product of Pittsburgh Corning Corp., is being used at General Tire & Rubber's Ashtabula plant to maintain rigid temperature control in four, outdoor, vinyl chloride tanks and their supply and refrigeration lines. The 14,500-gallon tanks, each measuring 27-feet long and nine feet in diameter, are encased in two-inch thick jackets of the closed-cell material. More than 1,000 feet of overhead supply and refrigeration lines are likewise encased.



Foamglas-jacketed storage tanks for vinyl monomers.

Curved Foamglas segments, measuring 12 by 18 inches, are fitted to the tanks by beveled lags and corrosion-resistant stainless steel bands. The joints are sealed, and the entire surface is coated with a fibrated asphalt cutback about ⅛-inch thick. Pipe lines are fitted with factory-shaped insulation.

The vinyl monomer, formed by the combined passing of acetylene and anhydrous hydrochloric acid through a bed of catalyts, is maintained in a liquid state at 50° F., and at 35 pounds pressure. The insulation eliminates the possibility of uncontrolled polymerization starting before the liquid enters the special polymeriation units. Installed three years ago, the Foamglas shows no signs of deterioration by the elements. Routine problems of temperature control are handled easily by existing personnel.

Laminating Vinyl to Metals

Two new techniques for producing vinyl-metal laminates have been developed by Arvin Industries, Inc. One development permits the welding of Arvinyl to metals of heavier gage than itself. Previously, the laminates could be welded to metal only one gage heavier than the laminate.

The other technique makes it possible to apply vinyl to both sides of a metal sheet, a desirable feature in the manufacture of cases, luggage, and toys. Vinyl-steel or vinyl-aluminum laminates produced by the

Arvin process can be formed and drawn in the same manner as straight metals. Thousands of designs are possible, and may be combined with Mylar polyester film to produce a metallized finish.

Reinforced Plastics Advance

"Sales of reinforced plastics for the first quarter of 1957 were 20-25% ahead of last year," according to Clare E. Bacon, reelected general chairman of the Reinforced Plastics Division, Society of the Plastics Industry, Inc. Industry production for the year of 1956 was 140-million pounds.

Mr. Bacon, manager of sales to molders for Owens-Corning Fiberglass Corp., pointed out that "an important factor in this advance was due to interest in reinforced plastic boats. Orders following this year's Motor Boat Shows were in excess of production capacity."

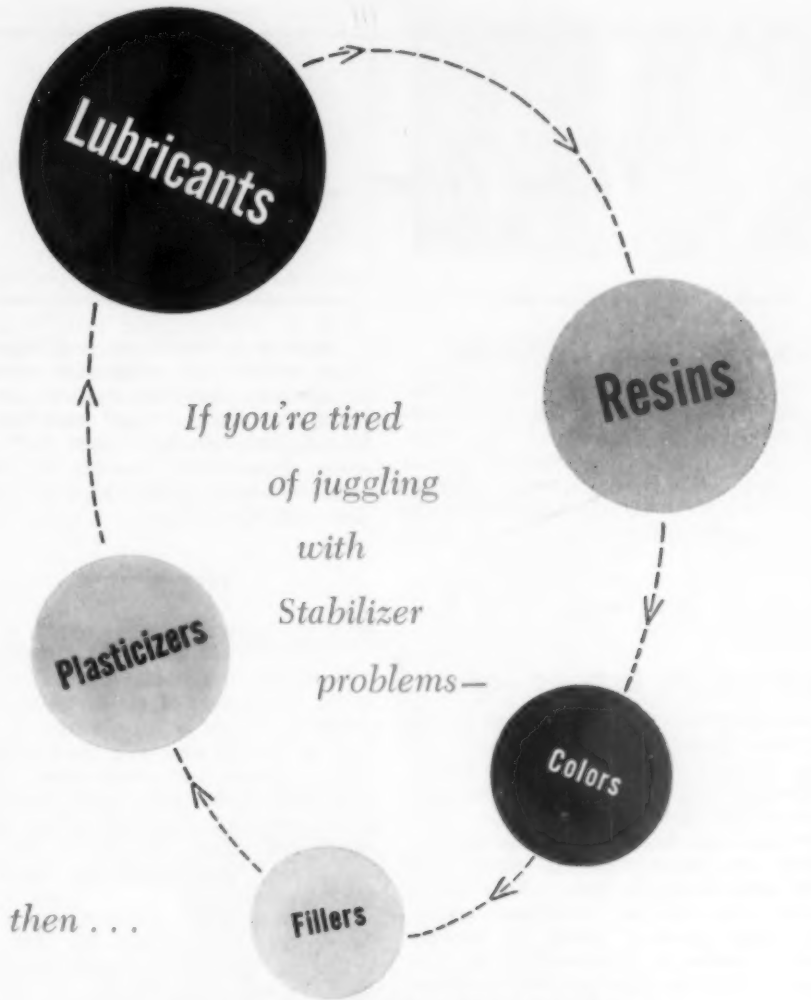
"Other factors accounting for these increased sales include the greater use of pre-mix compounds by the automotive industry," he added, "since these materials offer the volume producers the advantage of large, intricate, one-piece parts at reduced assembly costs. Improved heat resistance is opening new fields such as transmission gears, appliance handles in color, and filament windings for missiles. Gains were reported for virtually all of the industry's major markets, including construction panels, molded seats, containers, appliances, and other consumer products."

Other annual officers elected to serve with Mr. Bacon are the three regional chairman: Eastern, Dan B. Hains, Consultant; Midwestern, Samuel A. Moore, Interchemical Corp.; and Western, George R. Huisman, Filon Plastics Corp. The following members were added to the executive committee: James S. Lunn, Lunn Laminates; Richard H. Malamphy, Naugatuck Chemical; and George L. Smead, L.O.F. Glass Fibers Co.

Plastics in Lighting Fixtures

Popularity of plastic fixtures for non-residential lighting is growing by leaps and bounds, according to a recent survey conducted by Dun & Bradstreet for Monsanto Chemical Co. In 1956, the number of lighting jobs specifying plastics increased 25% over the preceding year. The survey also indicated that all-plastic lighting fixtures accounted for 35-40% of the $200-million market.

Advantages of plastic fixtures, as cited by architects and engineers, include low breakage, even light distribution, and low weight. The four major types of non-residential lighting include the following: surface mounted, pendant mounted, recessed troffer, and luminous ceiling.



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News from Abroad

Names Japanese Distributor

Chugai Boyeki Co., Tokyo, has been named exclusive Japanese sales representative for Frank W. Egan & Co., Somerville, N. J. The latter firm manufactures plastics extruders, dies, and accessories. The Boyeki firm's New York affiliate is Robeco Technical Equipment Corp.

Plastics in the United Kingdom

Sales of plastics materials in the United Kingdom reached a new record of 324,120 tons during 1955. This represents an increase of 16% over 1954, and is more than double the 1950 total.

Britain's anti-inflationary credit squeeze, which has been increasing since early 1955 and includes higher bank rates, greater restriction on installment buying, and higher purchase taxes, has brought about a downward adjustment in the production of plastic materials used in radios, television sets, and automobiles. This has resulted in a slow-down in the sales of PVC and polystyrene resins.

Thermoplastic materials continue to lead, with all types showing increases but polystyrene which declined slightly below the 1954 level. For the first time, sales of thermoplastics exceeded those of thermosetting materials. Sales of polyethylene and vinyl chlorides increased by more than 20%, acrylics rose 13%, and the remaining materials showed increases up to 10%. Total thermoplastics sales advance, over 1954, was 21%.

Sales volume of thermosetting materials has increased with phenolics and cresylics rising by 15%, amino plastics by 9%, and casein plastics by 30%. The casein products, however, represent a small proportion of total sales.

Estimates, based on plans of leading thermoplastics manufacturers, indicate that within two or three years the annual production capacity should increase to 117,000 tons for PVC, and to 159,000 tons for polyethylene. Current annual output, gathered from trade sources, shows: PVC, 50,000-55,000 tons; polyethylene, 25,000 tons; and polystyrene, 11,000-22,000 tons.

Exports rose to nearly 85,000 tons in 1955, as compared with 73,000 tons during the preceding year. These figures do not include a substantial amount of plastic materials, exported in the form of finished products and as component parts. Import restrictions, resulting from Britain's dollar shortage, limit the importation of plastic materials. The consumer is expected to buy from local producers when materials or reasonable substitutes are available. American products are preferred to other foreign materials, and United States producers are well represented in the British market through direct investment or through close association with local firms.

Plastics in New Zealand

Forty-two manufacturers are engaged in the production of plastic goods. Their products include a wide range of items such as kitchen and table ware, toiletries, radio cabinets and components, garden hose, cold water pipe, bottle caps, electrical switches, plugs, and plastic coated wires and cables. Auckland, the Hutt Valley, and Christchurch are the centers of the industry.

Plastic materials consumed during the 12 months ending March 31, 1955, were valued at $2,933,398. About $2,577,784 went for molding materials; the rest for plastic sheeting, casein, and other materials. Total output of plastics products was valued at $7,379,838.

With the exception of casein, practically all plastics materials are imported. In 1954, imports of thermosetting molding powders amounted to 1,393,280 pounds and other molding powders to 2,271,168 pounds. Imports of sheet plastics amounted to 1,734,096 pounds. New Zealand's chief material supplier is the United Kingdom, with small imports coming from the United States.

Molding powders are exempt from import licensing, whatever the source of supply. Other plastics materials, resins, and fiberglass may be imported without license only from sterling sources. Dollar licenses are granted where advantageous, and the tariff on thermoplastic and other resins is 3%. This rate applies to most other materials, although in some cases British preference is accorded.

Australian Plastics Industry

Expansion plans now under way in the Australian plastics industry are expected to further reduce the country's dependence on imported plastics materials and articles containing plastics components. Domestic production now meets the major requirements in this field. Imports, limited to materials not available domestically, favor products originating in the United Kingdom and Western Europe.

Polyethylene, PVC, polystyrene, and phenol-formaldehyde resins are the four main materials used in Australia. Currently, polyethylene is the only one not manufactured locally, but Imperial Chemical Industries of Australia and New Zealand has announced plans to build a polyethylene unit near Sydney. Completion is scheduled for the end of 1957, at which time an initial annual production of 3,000 tons is expected. This will meet Australia's total polyethylene requirements which are approximately 2,000 tons a year.

Three major producers are expanding their phenol-formaldehyde capacity to 6,000 tons a year, which is about double the present output. Urea- and melamine-formaldehyde capacities are being expanded to meet current demands and future markets. Both PVC and polystyrene have capacities of about 6,000 tons a year, figures which slightly exceed existing demands.

Plastic materials which Australia may not find economical to produce in the near future include acrylics, currently being imported at a rate of about 700 tons a year, nylon, silicones, epoxy resins, special cellulosics, fluoroethylene, polyurethanes, and natural resins. Urea and PVA, which may be produced domestically in the near future, are being imported in addition to hexamine, styrene monomer, and cellulose.

German Documentary Service

In early 1955, the German Plastics Institute in Darmstadt established a "Rapid Service of Literature on Plastics" on behalf of the Research Association for Plastics, Frankfurt am Main. In addition to German patents and individual papers, the service now covers 117 domestic and foreign journals.

The abstracts appear monthly, and a typical issue covers 500-600 items in 60-70 pages. The service aims at presenting a world-wide survey of original articles on the latest developments in research in the fields of plastic, rubber, and high polymers. New goods and some news of the industries are noted.

Copies of the publication are obtainable from the Deutsche Kunstoff-Institut in Darmstadt. Annual subscription for members is 80 DM (Deutsche Mark), and 200 DM for non-members.

Plans Epikote Production

The facilities of Rheinische Olefinwerke G.m.b.H., Wesseling, will be expanded to allow for the annual production of 2,000 tons of epikote resins. Commercial production is scheduled for the middle of 1958. Rheinische Olefinwerke is owned jointly by Deutsche Shell, A.G., Hamburg, and Badische Anilin u. Soda Fabriken, Ludwigshafen, Germany.

Names in the News

Photo by: Walton Jones

Harold C. Klassen

Harold C. Klassen has been appointed sales manager of plastics for Jones-Dabney Div., Devoe & Raynolds Co., Inc., Louisville, Ky. He also will be responsible for the recently-established plastics technical service department.

S. D. Naistat and **Joseph Bomstein** have been promoted to manager and assistant manager, respectively, of inorganic and physical-chemical research and development for Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y. Dr. Naistat joined the firm in 1950 as a chemist, and was promoted to assistant manager of the inorganic and physical-chemical group in 1956. Mr. Bomstein joined Becco in 1954 as a chemist in the research department. In his new post, he will retain his present duties as supervisor of the analytical section of the research and development department.

L. O. Oldsberg and **J. J. Shay, Jr.**, have joined the plastics division of Monsanto Chemical Co., Springfield, Mass., as research chemical engineer and sales technical service representative, respectively. Dr. Oldsberg received a Ph.D. in industrial engineering from Chalmers Institute of Technology in Sweden. Mr. Shay holds a B.S. in chemical engineering from Northeastern University.

W. P. Orr has been made assistant general manager of the plastics division of Celanese Corp. of America, Newark, N. J. He formerly was manager of the company's new polyolefin plastic plant at Houston, Tex., and joined Celanese in 1945 as a chemical engineer in process operations at the Bishop, Tex., chemical plant. After various posts in Celanese's chemical division, he transferred to the plastics division in late 1955 as project manager for design, engineering, and construction of the Houston plant. He is succeeded as plant manager here by **B. E. Cash,** previously assistant manager of the plant. A chemical engineer, Mr. Cash joined Celanese in 1936 as a development engineer at the Newark plastics plant, and served subsequently in various managerial capacities at the company's plastics plants in Newark and Belvidere, N. J., before transferring to the Houston plant last year.

J. T. Dunn, former research chemist and group leader, has been named assistant to the director of research for Union Carbide Chemicals Co., New York, N. Y.

Anthony J. Simonson

Anthony J. Simonson has joined Thiokol Chemical Corp., Trenton, N. J. as manager of market development. He formerly was assistant general manager for Borne Chemical Co.

Roland A. Barone has joined the reinforced plastics division of The Brunswick-Balke-Collender Co., Marion, Va. He will serve as plastics project engineer on aircraft and missile components.

Paul H. Connair has joined Resistoflex Corp., Roseland, N. J. as a field engineer. Headquartered in Dayton, O., he will be responsible for the St. Louis, Mo.-Cincinnati, O.-Columbus, O. area.

A. T. Look has been advanced to superintendent of the Styrex section, The Dow Chemical Co., Midland, Mich. **Harold Bosscher,** former superintendent of the saran section, has been named section superintendent in charge of all Styron operations in the Midland division. He is succeeded by L. C. Friedrich, former assistant superintendent.

E. C. Brown, Jr. Edmund D. Lutz

Edmund D. Lutz has been appointed northeastern district manager for the films and flooring division of Goodyear Tire & Rubber Co., Akron, O. In his new capacity he will be headquartered in New York, N. Y., where he will coordinate all sales activities of packaging, flooring, and vinyl film field personnel in the northeast. **E. C. Brown, Jr** has been assigned to the New York, N. Y. office of the chemical division. He will assume the field duties of **J. Drexler** who recently was transferred to Goodyear International Corp. **Richard T. Clatterbuck** has been assigned to packaging film sales and **Anthony G. Dubrick** to flooring sales both men to be located in Chicago, Ill. **John Platner** has been named assistant manager of the coating department, replacing **G. H. Campbell** now of Goodyear International Corp. **E. W. Scott,** former sales service representative, is now manager of sales development for that department, and **J. P. Talley** will succeed him to the sales service position.

J. P. Wilkins has been appointed assistant manager of industrial sales for the film department of E. I. du Pont de Nemours & Co., Wilmington, Del. He is succeeded as assistant manager of sales development and technical service by **W. H. Wood** who, in turn, is succeeded by **H. S. Carl, Jr.,** as sales development supervisor. Dr. Wilkins joined Du Pont in 1946 as a research chemist, and was named to his most previous post in 1955. Dr. Wood came to the company in 1939 as a chemist at the Experimental Station, transferred to the film department in 1955, and was promoted to sales development supervisor last year. Mr. Carl, a sales development specialist since 1955, joined Du Pont in 1950 as an engineer at the Clinton, Iowa, cellophane plant, and was promoted to shift supervisor there in 1953.

Jerome Kurtz has been appointed technical service engineer for Ferro Chemical Corp., Bedford, O. He will give technical assistance to users of Ferro's polyvinyl chloride resin heat and light stabilizers, and will be headquartered at the company's main offices and laboratories.

Robert N. Pittilo has joined the plastics division, Monsanto Chemical Co., Springfield, Mass., as research chemist.

Dr. L. H. Sutherland

L. H. Sutherland has been appointed section head in the research program of Escambia Chemical Corp., New York, N. Y., where he will be in charge of the analytical and certain of the process groups. His activities will be divided between Cambridge and Newton, Mass., where the company presently has its research and technical service facilities. Coming from American Cyanamid Co., where he was chief development chemist, Dr. Sutherland joined the Escambia group at National Research Corp. in 1956.

Edward H. Yons, former assistant to the president, G. Felsenthal and Sons, Inc., Chicago, Ill., has been appointed production manager for the firm's fabricating division.

D. K. Webber has joined the technical service department of Monsanto Chemical Co.'s plastics division at Texas City, Tex. Holder of a B.S. in chemical engineering, he previously worked in design and development for California Research Corp.

R. J. Gall and **J. R. Hopkins** have been promoted to assistant manager of organic research and development and technical assistant to the sales manager, respectively, for Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y. Mr. Gall, holder of an M.S. in chemistry from Canisius College, joined Becco in 1947 as a member of the research department, and was group leader of organic research and development since 1954. Mr. Hopkins joined Becco in 1935 and, most previously, was assistant manager of the southern territory.

Three men have been appointed to the Clifton, N. J., applications laboratories of W. R. Grace & Co.'s Polymer Chemicals Div., New York, N. Y. **N. F. Smith,** formerly with Monsanto in Canada and Springfield, Mass., becomes a technical representative of Grace's marketing department. **Albert Spaak,** formerly chief engineer for DeMattia Machine & Tool Co. and Mastro Plastics Co., has been named injection molding engineer for Grace's technical service department. **Ruben Thevenet,** whose experience includes work with the General Electric Co.'s plastics division, joins the Grace technical service department as a plastics extrusion engineer.

James M. Brady has been appointed assistant general sales manager of the Pla-Tank division, Haveg Industries, Inc., Wilmington, Del. He formerly was district sales manager of the company's home office territory, in which position he is succeeded by **John H. Leary.**

Whiting N. Shepard

Whiting N. Shepard has been appointed manager of Plaskon Molding compound sales for Barrett Div., Allied Chemical & Dye Corp., New York, N. Y. He succeeds **Henry W. DeVore,** who was promoted to director of plastics and resins sales. **Thomas A. Bennett** has been assigned to the sales training program which will include a two-year training period in the company's laboratories. **James L. Eyre** has been named sales representative for Plaskon molding compounds for the Barrett Co., Ltd., Toronto. He will service the Montreal and Toronto districts.

R. E. Workman, manager of the Chemical division of Goodyear International Corp., Akron, O., a subsidiary of Goodyear Tire & Rubber Co., was one of the 36 men chosen from industrial concerns in the United States, Canada, and Mexico to be awarded a Sloan Fellowship for participation in the executive development program at M.I.T. The one-year program started in June.

Daniel Mackeffey has been named plant engineer for Santay Corp., Chicago, Ill. He formerly was hydraulic and electical maintenance foreman.

Reinforced Plastics

(*Continued from page 564*)

Hours Board gives us a good idea of the man-hours in each section of the plant and the time spent on various operations. This operational cost break-down provides us with a valuable time estimate that helps us in determining what a similar job might cost. Here, again, these facts are necessary for the estimator to have on hand. This Individual Man-Hours Board also indicates how much time is left in each department that could be utilized for new work coming in.

Such "aids" provided by management teamwork help the estimator immeasurably. Instead of having to spend hours in the plant watching individual operations, the Control Board and Man-Hours Board give him a broader concept of what is going on and what he should know in preparing his estimate.

Some of the "invisable" bogs which estimators might fall into are forgetting the laboratory time spent in testing and evaluating the sample parts before production begins. Often, they think in terms of production and finished parts, completely overlooking the "also-ran" costly activity in the laboratory.

Another slip-up might occur in forgetting the yardage of PVA material used in bag molding. This often happens because the estimator is aware of the materials that went into the sample part before him, but he does not see the PVA bag that was used in the lay-up and subsequently discarded. This can be a costly mistake. It is interesting to note that in checking and rechecking such an estimator's figures, management often may duplicate his error because they also omit the PVA bag from their calculations.

One of the principle headaches in the estimating picture is the estimating of time schedules. Many behind-the-scenes activities necessary to the finished job may involve unexpected delays. A labor strike at a supplier can throw off a delivery schedule and cause serious complications to the customer. Unavailable material or miscalculation of inventory stock also will hold up production. Therefore, an estimator should allow sufficient time for unexpected delays and interruptions when projecting the delivery date in his estimate to the customer. Cancellations of contracts often result from a number of such small, unexpected incidents.

There is no actual yardstick that the estimator can use to protect himself from these situations arising. Had he planned ahead intelligently, using a time schedule to guard against these pitfalls, he would have allowed for production recovery without endangering the delivery date.

Haste in getting an estimate to the customer and anxiety to obtain the contract may cause the estimator to make delivery-date promises that would be hard to meet even when the operation is under-way. Care should be taken to think out logically a practical time estimate.

Although the emphasis here has been on underbidding, actually just as much harm can result from overbidding. The reinforced plastics industry would benefit immeasurably if standards could be established to afford the molder a definite margin of profit. Most of the failures resulting from incorrect estimates were due to underestimating unintentionally on one of the points I covered.

At Lunn, we have developed special estimating forms which we think have helped us solve some of these problems. We will be glad to provide them without charge to anyone interested in writing for them.

—THE END

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Aerosol Mold-Release Agent

A mold release and parting agent in aerosol form has been introduced by Allied Chemical & Dye Corp.'s Barrett division. Trade-marked Poly-Lease 77, the release agent consists of low-molecular weight polyethylene in a mixed solvent system. Genetron is used as the propellant.

Poly-Lease forms a smooth, relatively-hard film on hot or cold mold surfaces. It can be applied directly to plaster, plastic, wood, steel, or aluminum molds; however, porous plaster molds require a sealant coat of shellac or lacquer before the parting agent is applied. Completely inert, it offers no finishing or casting difficulties.

The mold release is said to work especially well with such thermosetting plastics and vulcanized compounds as phenolics, rubber-phenolics, melamines, ureas, polyesters, alkyds, and rubber. It has proved effective in casting or potting of epoxies, phenolics, furanes, and polyester resins. It has been particularly successful in the casting of epoxy plastic prototypes and tools because it permits repeated reproduction of parts in the same mold.

Success also has been reported in the field of powder metallurgy. Sprayed on powdered metal, the release agent forms a uniform film which prevents chafing of the mold and eliminates the need for additional binders. No porosity is found in the metal, nor deleterious effect in the grain strength.

Poly-Lease 77 is packaged in an 18-ounce "Crown" can with concave base and tepered top. This heavy-walled container is designed to hold pressurized gases and liquids, conforming to I.C.C. regulations. Atomizer valve is actuated by finger-tip pressure, and is protected by a removable metal cap when not in use.

Readers' Service Item M-1

Primary Plasticizer

A plasticizer which can be used as a direct replacement for dioctyl and diisooctyl azelate, and dioctyl and diisooctyl sebacate, has been introduced by Lehigh Chemical Co. Designated X-1240, the material features low volatility, high plasticizing efficiency, low soapy-water extraction, and excellent heat stability.

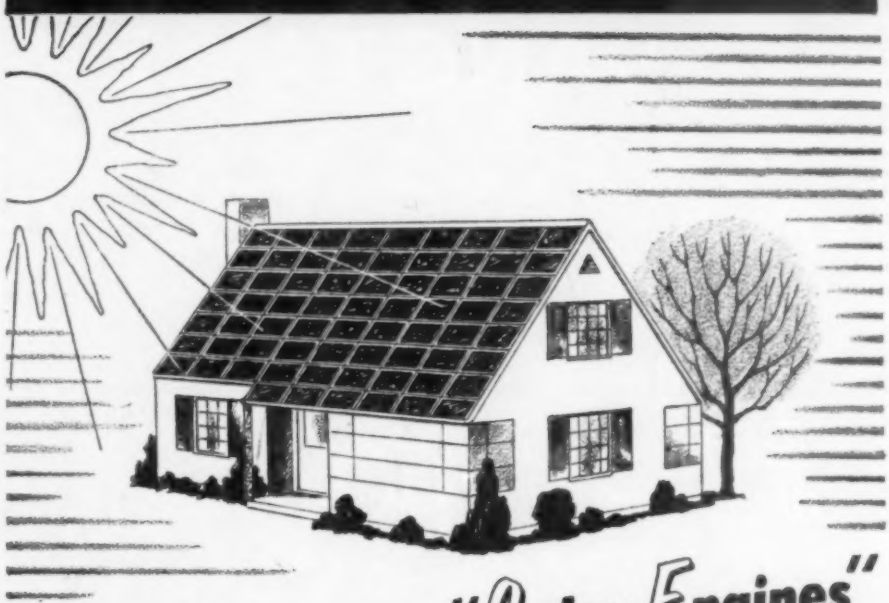
X-1240 is recommended specifically for plastics which are to be used under low-temperature conditions or outdoors. It is compatible with cellulose acetate, butyrate, vinyl chloride-acetate copolymers, vinyl chloride, nitro-cellulose, and common synthetic rubbers. Reportedly, its only drawback as a primary plasticizer is its instability to ultra-violet light.

Physical properties are as follows:

Color, ASTM	4
Specific gravity	0.92
Weight, lbs./gal.	7.67
Acid number, mg. KOH/gm.	0.5
Molecular weight	420
Viscosity @ 77° F. cps.	25
Flash point, °F.	430
Fire point, °F.	465
Pour point, °F.	–70
Boiling point, °C.	243

Readers' Service Item M-2

"Colloid Corner" by COLUMBIAN



Sub-Microscopic "Solar Engines" turn Light into Heat

In the solar-heated house, carbon black's ability to turn the sun's radiation into useful heat makes it invaluable as a pigment for the roof paint. The same ability is harnessed to melt harbor ice, to replace asbestos in thermal insulation, and for other uses. Columbian Carbon Company can provide colloidal carbons with particle sizes from 9 to 90 millimicrons. These may have rough surfaces or smooth, high or low structure, and controlled degrees of adsorption and absorption. All these qualities—and more—can be varied to custom-make a wide and useful variety of distinct colloidal carbons. Consult us about your application. Use our richness of experience—it is at your service. Or send now for our free technical booklet on properties of carbon blacks.

For Progress in Colloids

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COLUMBIAN Carbon Blacks are available in three forms: POWDER • BEADS • DISPERSIONS

Seven Colored Epoxy Hardeners

The advantages of colored hardeners for epoxy resins are two-fold: first, they enhance the decorative appeal of epoxy resins; and second, they enable the user to determine by visual inspection whether thorough mixing has taken place. Striations, streaks, and uneven color distribution indicate improper mixing, something which could not be determined previously by casual inspection.

Seven colored hardeners, based upon previously-available safety hardeners, have been introduced by Furane Plastics, Inc. They offer ease of identification for laminated and cast plastic tools; and piping, through their use as colored sealants. Colored-epoxy potting compounds offer attractiveness along with identification, and integrally-colored epoxy structures do not require painting.

Hardener 9810 is neutral colored, has a viscosity of 500-700 cps., and has good light-fastness. Hardener 9810-10 is blue, has excellent light-fastness, and has a viscosity of 600-1,000 cps. Hardeners 9810-20 (yellow), 9810-50 (orange), and 9810-60 (green) are very light-fast and have a viscosity of 800-1,000 cps. Hardener 9810-30 is red, has a viscosity of 1,000-1,200 cps., and has a good light-fastness. The viscosity of black Hardener 9810-40 is 1,200-1,500 cps., and its light-fastness is reportedly excellent.

Readers' Service Item M-3

Liquid Glycol Defoamer

A ditertiary, acetylenic glycol which acts as a low-foaming, non-ionic surfactant has been introduced by Air Reduction Chemical Co. Called Surfynol 104A, the material has shown excellent results in defoaming PVA and latex paints, coating and resin-sizing of papers and textiles, metal cleansers, starch and protein adhesives, and low-sudsing detergents.

The solvent for 104A is 2-ethyl hexanol. The amount of active material contained in the solution runs about 50%, and the surface tension runs about 36 dynes per centimeter. Solidification point is approximately 0° C., and excellent high-temperature stability is reported.

Readers' Service Item M-4

Ceramoplastic Mold Material

A moldable, ceramoplastic, insulating material known as Supramica 560 has been introduced on the market by Mycalex Corp. of America. Capable of withstanding continuous operating temperatures in excess of 500° C., the material is dimensionally stable, radiation resistant, and lighter in weight than its predecessors.

Supramica 560 was found to withstand short-time operating temperatures in the neighborhood of 1,200° F., depending upon the mass and configuration of the part. Moldable to close tolerances, the material is expected to find application as aircraft and missile components, and other equipment requiring reliability under extreme conditions.

Properties are quoted as follows:

Dissipation factor, 1 meg.	0.0035
Dielectric constant, 1 meg.	6.8
Loss factor, 1 meg.	0.024
Volume resistivity, ohm-cm x 10^{13}	5
Specific gravity	2.8
Water absorption, 24 hrs.	Nil
Hardness, Rockwell M.	125
Thermal expansion per °C. x 10^{-6}	13

Readers' Service Item M-5

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

Film, Sheeting, Molded Products

Use 1–1.5 VANSTAY HT with .5–1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

Oliver

R. T. Vanderbilt Co., INC.
230 PARK AVENUE, NEW YORK 17, N. Y.

Four Non-Ionic Surfactants

A series of four polyethers, intended for use as non-ionic surface-active agents in the manufacture of polyurethane foams, has been introduced by the Michigan Alkali division of Wyandotte Chemicals Corp. Designated Pluronics F68, L44, L62, and L64, the materials are said to offer two major advantages over polyester resins in foam production: improved resistance to aging and lower cost.

The polyethers are actually block polymers based on propylene and ethylene oxides with high molecular weights. Both flexible and rigid foams are prepared by the reaction of these materials with toluene diisocyanates. Wyandotte also has available on odorless, piperazine-derived catalyst and a cross-linking agent trademarked Quadrol. The latter, a condensation product of propylene oxide and ethylene diamine, is said to offer promising rigid foams both with polyethers and with castor oil-based formulations.

Physical properties are reported for the Pluronics as follows:

	L44	L62	L64	F68
Form	Liquid	Liquid	Liquid	White flakes
Odor	Slight	Slight	Slight	Slight
Active agent, %	100	100	100	100
Specific gravity	1.05	1.025	1.04	—
Viscosity, cps.	350-800	300-500	400-900	—
Pour point, °C.	12	—11	21	—
pH	6-8	6.8	6.8	6.8
Molecular weight	2,000	2,000	3,000	8,000
Moisture pick-up, %, 7 days	1.7	3	3.4	3.6
After 30 days	4.7	4.6	7.3	5.6

Readers' Service Item M-6

General Purpose PVC Resin

A medium-viscosity, general-purpose PVC resin for calendering clear film and sheeting has been developed by Goodyear Tire & Rubber Co. Called Pliovic S70, the material is processed readily at temperatures which would be marginal or impossible for higher molecular-weight resins.

Pliovic S70 can be used to temper high-modulus stocks, thus extending the utility of equipment and permitting the production of a greater variety of vinyl products. Compatible with all common vinyl plasticizers, it is stabilized with barium-cadmium, tin, or lead systems. Specific gravity is 1.4, and the inherent viscosity runs about 0.86. Average particle size is 40 microns, and the bulk density is reported at 44 pounds per cubic foot.

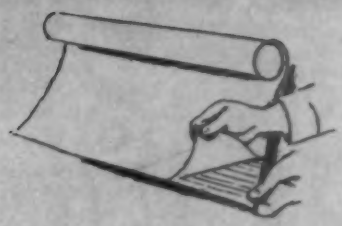
Readers' Service Item M-7

Today's answer to

RELEASE PROBLEMS . . .

Patapar® Releasing Parchments

As a tray liner for molding polyurethane foams, Patapar releases easily — does not pit the surface of the foam.



Patapar is the ideal protective backing for pressure sensitive plastics — can be attractively printed for product identification.

In the manufacture of polyester Fiberglas sheets, Patapar provides an efficient release backing. Imparts satin-like finish.

Patapar performs perfectly as a separator for rubber tape. Also used as a core cover.

Ideal as a protective release backing for pressure sensitive surfaces. Fiber-free, Patapar will not form a fuzz on the protected surface.

Effective separator for uncured, natural or synthetic rubbers. Imparts a smooth surface. Resists adhesion build up.

Patapar Releasing Parchments have dense, fiber-free texture – high resistance to penetration or migration of oil and softeners – permanent releasing action. They are totally inert to any surfaces they contact.

They show excellent performance in many processes involving: *synthetic rubbers, polyurethane foams, polyesters, vinyls, organic adhesives, organosols, phenolics, acrylics.*

A brochure of testing samples and detailed information is available on request. If desired we will give technical assistance on your releasing problems. Write us on your business letterhead.

Patapar®
RELEASING
PARCHMENT

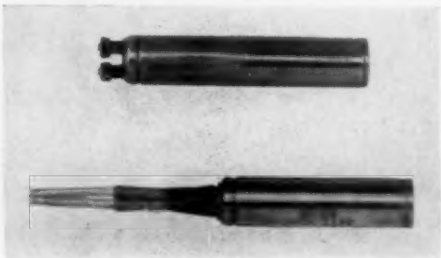
OTHER PATERSON PRODUCTS
*PATAX waxed paper
*DURAPAK parchmentized cellulose
*PATERSON absorbent paper
*PARCHKIN art parchment

PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
Sales Offices: New York, Chicago
West Coast Plant: Sunnyvale, California

HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

New Equipment

Write item numbers on Readers' Service Card to obtain more information.



Mighty Watt cartridge heaters.

Cartridge Heating Elements

Ogden Mfg. Co.'s Mighty Watt cartridge heating units for dies, platens, process machinery, molds, and melting pots are now insulated with a nickel-alloy sheath. The new sheath is standard for 1,000° F., operation, as opposed to the formerly-used brass sheaths which were rated at 750° F. In addition, the nickel alloy cuts oxidation which retards the transfer of heat and is a common cause of premature burn-out.

When heated, thermal expansion forces the cartridge surface into positive, firm contact with all surrounding areas. This assures maximum heat transfer without binding. Thermal conductivity reportedly is equal to that of brass, and the alloy is resistant to glue and water corrosion. Mighty Watt cartridge units are available in 3/8-, 7/16-, 1/2-, 5/8-, 3/4-, 15/16-, one-, and 1 1/16-inch diameters, and in lengths of 1 3/8-16 inches.

Reamed holes for the cartridges should be drilled to exact dimensions. Gaps and over-size holes prevent complete metal-to-metal contact, causing hot spots which affect the life of the unit. No cooling-off period is required for removal. The smaller-sized cartridge units should be used with 115-volt heaters, which can be connected in series on 230 volts.

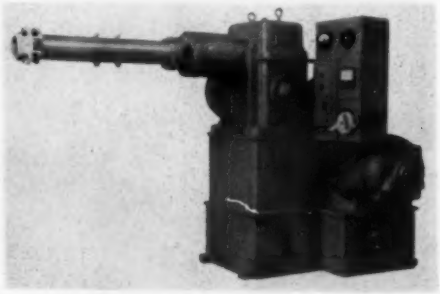
Readers' Service Item E-1

Heavy-Duty Extrusion Unit

An extruder featuring a one-piece, heavy-walled, jacketed, steel cylinder with a removable Xaloy 306 liner, has been introduced by Rolis, Inc. Depending on requirements, the cylinder may be jacketed for zoned oil—or electrical—band heating with water cooling. A separate hopper section also is water-cooled. The extruder, worm reduction unit, and motor, are mounted on a heavy steel, one-piece base for added stability.

The screw, cored for water cooling, is made of precision ground, chrome-plated, alloy steel with stellited flights. It has a 20:1 L/D ratio. The die holder is electrically heated, and a pre-wired temperature control panel houses indicators, controllers, and gages. The unit is provided with oversize roller thrust bearings which are lubricated by a simplified gravity-feed system. The extruder is available in all sizes from 1-4½ inches.

Readers' Service Item E-2



Rolis 20:1 L/D extruder.

Injection Molding Machine

An injection molding machine featuring a shockless, closed-circuit, hydraulic operating system has been introduced by National Automatic Tool Co., Inc. Called the Natco 400, the unit has a 425-ton straight-hydraulic mold clamp with a 26-inch stroke, and is powered by two electric motors of 40- and 7½ hps.

Ram reversal is accomplished by reversing the radial piston pump, thus obviating the need for four-way operating valves. Maximum distance between platen and die head is 50 inches, and the minimum mold thickness possible is 12 inches. Mold mounting platens measure 38 by 38 inches, and the clearance between tie rods is 25 by 25 inches.

Plasticizing capacity of the Natco 400 is 165 pounds per hour for general purpose polystyrene. The mold-filling rate is 1,140 cubic inches per minute, and the maximum injection shot can be made in 3½ seconds. At 20,000 psi. injection

you pay no more for the best!

REPLACE
your burned out heating units with

- Longer-Lasting
- Better-Heating

WATLOW Narrow Banded Units

For top performance on your injection and extrusion molding machines, depend on Watlow Narrow Banded Heating Units on your heating chambers.

New, non-expanding clamp design gives tighter fit, assures faster, more uniform heat transfer and fewer burnouts.

Pioneers and leaders in the field of narrow band design

WATLOW ELECTRIC MFG. CO.
1364 FERGUSON AVE.
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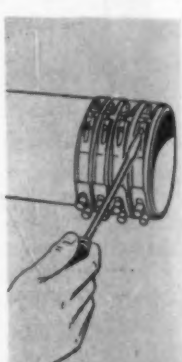
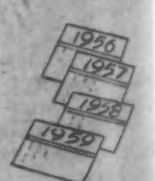


Installs Faster!
Two-piece design saves time. Goes on without disturbing other heaters!



Lasts Longer!
Lower internal operating temperature, plus exclusive new tite-fit clamp!

Natco 400 injection molding machine.

pressure using a single plunger feed, the machine has the following shot capacities: 28 ounces of polystyrene, 16 ounces of standard polyethylene, and 31 ounces of cellulose acetate. Double-shot feeds are rated at 34, 27, and 50 ounces, respectively.

While many hydraulic machines of similar capacities require 3-5 seconds of clamp-pressure build-up time, the Natco 400 requires only 0.6-second to develop the full 425 tons of pressure. Clamp-closing speed is 12 inches per second, without shock or slam.

Other features include interchangeable injection plungers and feed bushings, which accommodate pressures up to 30,000 psi.; automatic pressure reduction after mold filling; plug-in pyrometers, timers, and heating bands; dual-voltage, leakproof heating chamber; compensating vibrating feed; slow-speed controls; and automatic lubrication.

Introduction of the Natco 400, first in a series of four standard sizes of injection molding machines, marks National's entry into the field of plastics machinery. The firm has produced metalworking equipment for the past 56 years.

Readers' Service Item E-3

Power-Operated Turret Winder

A two-shaft, power-operated turret winder designed for use with an extruder laminator has been placed on the market by Hobbs Mfg. Co. Designed to accom-

Hobbs-Alquist Two-Shaft Turret Winder.

Apart from a full line of Temperature CONTROLLERS

users have proved *these* instruments by WEST

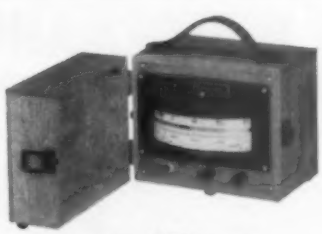
MODEL I SERIES

High Resistance indicating pyrometers

Complete Control Systems handily centralizing instruments

MODEL RT SERIES

Resistance Thermometer indicators (and controllers)



MODEL IE SERIES

Portable high resistance indicators

MODEL IN SERIES

Multi-Point indicators with TC switches

MODEL M SERIES

tubeless electronic potentiometer strip chart Recorder

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For data on these or controller instruments, use your classified phone directory or write direct.

the trend is to WEST

modate rolls of Kraft paper, poly-coated cellophane, vinyls, and the like, the unit is equipped with an automatic cut-off and roll-starting device which completely eliminates down time.

Previously-available winders had to be stopped when each roll was completed. The Hobbs-Alquist unit makes the winding process continuous, and is reported to increase production by 25%. It accommodates rolls up to 40 inches, depending upon core size, at speeds up to 500 feet per minute. Maximum roll width which can be handled is 72 inches, and maximum roll weight is 1,500 pounds.

Readers' Service Item E-4

Model 3XX grinder has 10x24-inch throat.

Beside-The-Press Grinders

Two grinders with large throat-openings have been introduced by Foremost Machine Builders, Inc. Intended for beside-the-press grinding of large filmans sheet scrap, the units have been designated Models 3X and 3XX. They are distributed nationally by the Rainville Co., Inc.

Model 3X is equipped with a five-hp. motor and starter; arranged for three-phase, 60-cycle, 220- or 440-volt operation. It has a 10- by 16-inch throat opening, and a 5/16-inch perforated screen. Floor-space requirements are 38½ by 30 inches, and the unit stands 60½ inches high. Weight is approximately 1,000 pounds.

Model 3XX is reported to have the largest throat (10 by 24 inches) of any grinder on the market. This factor makes it particularly adaptable to the grinding of polyethylene houseware scrap. The unit is equipped with two five-hp. motors and two five-hp. starters; arranged for three-phase, 60-cycle, 220-volt operation. The standard model is complete with casters, bin, and hopper tray two feet above the top of the knives. Floor-space requirements are 42½ by 30 inches, and the height is 68 inches. Model 3XX weighs 1,250 pounds.

Readers' Service Item E-5

Electronic Micrometer

An electronic micrometer for measuring any material requiring light anvil pressures has been introduced by J. W. Dice Co. Called the Carson-Dice Model M, the unit has an accuracy of 0.00002-inch on polyethylene, vinyls, thin films, and foils. It measures nine inches high, eight inches wide, and six inches deep.

The lower anvil of the micrometer is retracting, and is capable of holding pressures of ¼-8 ounces. Work pressure is controlled by the interchangeable, upper-anvil spring, which is made of beryllium copper. The anvils are lapped flat and parallel, with the lower anvil so designed as to return to its seat with less than a 10 millionth-inch variation. Normal service loads will cause no observable difference in the dial setting.

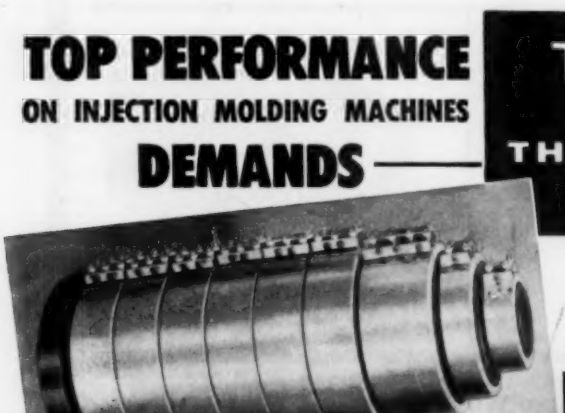
The electronic circuit gives a positive response for movements as small as five millionths-inch at the point of contact. This happens before the micrometer screw puts any pressure on the anvil. The measuring operation has no effect on the load, unless the micrometer screw is deliberately over-traveled. Standard, radio-type tubes are used, with 110-130 volt AC current. The unit is protected from electrical damage by a fuse in the terminal panel.

Carson-Dice Mode M electronic micrometer.

Readers' Service Item E-6

TOP PERFORMANCE
ON INJECTION MOLDING MACHINES
DEMANDS

THERMEL®
STRIP
THERMABAND®
(TYPE B)



Typical Installation on IMS Injection Cylinder

• FOR ALL MAKES AND MODELS

Thermastrip Bands showing details of construction, including grooved aluminum shoe and tubular elements.

- **Full Circle Heating — No Cold Spots.**
- **Positive Pressure — expansion contact of aluminum shoes.**
- **Rapid Assembly — installation of band or any part in seconds on *HOT CYLINDERS*.**
- **Contamination of Terminals and Wiring reduced to minimum.**
- **Exceptionally *long-life* Tubular Elements — even at 440 volts.**
- **Complete Interchangeability — of individual component parts.**
- **Semi-Flexible — adaptable to ¼" variation in cylinder diameter.**
- **Cost competitive with ordinary strip types.**
- **Available 1½" or 2½" widths. Diameters 4" to 12" I.D. standard.**

ONE WEEK DELIVERIES NOW BEING MADE

Write—wire for full details **DISTRIBUTOR'S ACCOUNTS WELCOMED**

Thermel, inc.
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New Products

Write item numbers on Readers' Service Card to obtain more information.

Regular and slotted nylon rubbing blocks.

Tiny Nylon Rubbing Blocks

Gries Reproducer Corp. has produced another miniature service part in plastics, nylon rubbing blocks. Available in two sizes, slotted and regular, the blocks bear against the distributor shaft of automobile engines. They lift the distributor points, opening and closing them as often as 100,000 times per minute. In spite of this constant, high-speed rubbing, the nylon blocks must not wear excessively.

Weighing as little as 0.03-ounce, the blocks are produced on fully-automatic molding machines which trim the gating and eject ready-to-ship parts. Nylon was found to be particularly adapted to this specific application, being self-lubricating and highly resistant to abrasion.

Readers' Service Item P-1

Polyethylene Game Ball

Cosom Industries, Inc., have come out with another boon for mothers—a lightweight, molded ball of Bakelite polyethylene. About the size of a conventional soft ball, the hollow sphere has large perforations which serve as a wind breaker. It weighs but two ounces, and can neither break a window nor injure a child.

Molded Polyethylene game ball.

The ball will not mildew, rot, or otherwise decompose. Mud can be washed off with soap and water to restore the clean, white surface. It can be hit with a bat up to 125 feet, and thrown up to 75 feet in distance The ball can be used for a number of conventional ball games, or used at the beach.

Readers' Service Item P-2

Nylon-insulated coupling for gas lines.

Nylon Dielectric Connections

A line of insulated couplings for gas distribution systems has been introduced by Plastic Engineering & Sales Corp. Designated Pesco, these dielectric pipe-connections consist of threaded sleeves of nylon molded within steel jackets.

Other plastic materials were found to offer chemical and electrical resistance, but did not withstand mold shrinkage, bending, side-thrust, and shock to the same degree as nylon. Perfect threads can be molded from nylon, and the Pesco couplings have withstood pressures of 1,000 psi., and temperatures up to 300° F.

A special locking device prevents the nylon sleeve from turning or slipping within its steel jacket. Available in all diameter sizes from ¾-2 inches, the couplings can be installed with standard operating procedures. The nylon used in this application was Plaskon, a product of Allied Chemical & Dye Corp.'s Barrett Division.

Readers' Service Item P-3

Wigwarm Outdoor Plant Protector.

Miniature Plastic Greenhouse

The Wigwarm Outdoor Plant Protector, a recent introduction by Aldon Products Co., forms a tent-like structure to provide miniature greenhouse protection for new transplants and seedlings. Supported by three aluminum ribs secured to a base ring, the moisture-resistant, Bakelite polyethylene cover fosters a humid atmosphere in the region of the plant and protects it from strong sunlight, frost, wind, and rain.

HAVE YOU TRIED

LOW COST MICA FLAKES For REINFORCING?

Increased electrical insulation. Compatible with all types of resins. Stocks in principal cities.

U.S. MICA CO., INC.
79 PROSPECT ST.
STAMFORD, CONN.

Alternate panels of opaque white- and transparent-film, act respectively as sun shades and observation windows. A top vent, used to prevent excessive heat build-up, is kept open at all times when frost is not imminent.

Currently available in one size, 15 inches in diameter by 17 inches high, Wigwarm plant protectors are inexpensive and easy to assemble. The three ribs simply are inserted into sockets in the base ring, and the polyethylene cover is put in place with an opaque panel facing the sun.

Readers' Service Item P-4

Personalized Plastic Sign

A one-piece, translucent vinyl sign with removable letters has been introduced by Emet Plastics Corp. Available with or without electrical illumination, the sign creates a visual effect similar to that of a theatre marquee.

Grooved channels, integral with the vacuum-formed base, are designed to receive three-dimensional block letters made of clear acetate, dyed a transparent red. One font of letters is provided with each sign and copy can be changed at will to spell out any desired advertising message, trade, or product name.

Moderate in cost, the signs are made to any specified size or shape and may be mounted to stand alone or hang from wall fixtures. Their flexibility makes them readily adaptable for use as bulletin boards; desk and wall plaques; and window, counter, and point-of-sale displays.

One-piece vinyl plastic sign.

Readers' Service Item P-5

Reinforced Plastic Whale

A giant, reinforced-plastic playground "whale" has been installed at the multi-million dollar Allweather Drive-In Theatre in Copaigue, N. Y. Produced by Firmaline Products, the whale was fabricated in much the same manner as boat hulls and automobile bodies.

Reinforced-plastic playground whale.

Approximately 1,000 pounds of Bakelite polyester resin went into the 32-foot long body, plus 100 pounds of woven glass fabric. About 500 pounds of sisal were used for the two-layer core, and the concave-scooped back was overlaid with Dynel fabric. The latter material, woven of Union Carbide's acrylic fiber, was used to provide the necessary high-abrasion resistance required of a children's slide.

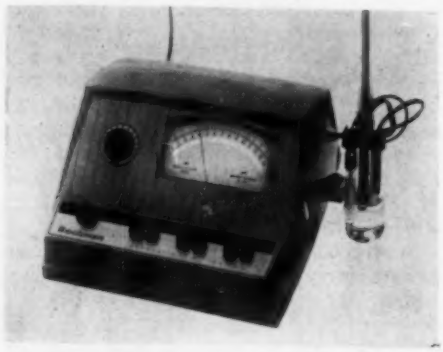
The whale's tail, rising 9½ feet high, is reached by climbing a realistic "ship's rope ladder." Designer of the structure is Dr. Joseph Brown of Princeton University's School of Architecture.

Readers' Service Item P-6

Two pH-Measuring Units

Two instruments for measuring pH have been introduced by the Scientific Instruments division of Beckman Instruments, Inc. A small, pocket model, and the 12-pound Zeromatic laboratory model are available, both with housings molded of American Cyanamid's Cymel 1077 melamine compound. Both are grey in color.

The pocket meter is a low-cost, precision instrument requiring no special skills to operate. Its two-piece Cymel housing has sufficient strength to protect the delicate mechanism from normal day-to-day carrying and handling. The unit is powered by six, replaceable batteries. The line-powered Zeromatic unit is designed to replace a former, metal-encased model. Housing for the pocket unit is molded by Beckman at its new plant in Fullerton, Calif., and the Zeromatic housing is molded by Eldron Mfg. Co.



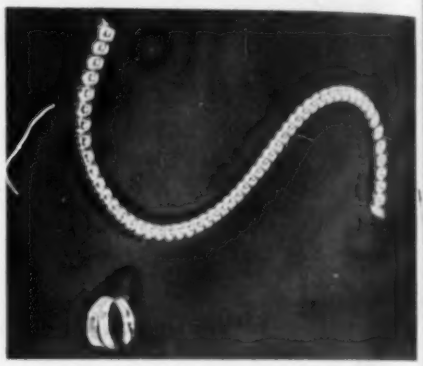
Melamine-housed Zeromatic pH meter.

Readers' Service Item P-7

Decorative Extrusions

An extruded plastic with a true metallic lustre, called Spectro-Chrome, has been developed by Schwab Plastics Corp. Available in gold, brass, silver, chrome, and anodized aluminum colors, the product is made by extruding a variety of clear and tinted translucent plastics over metallic core materials.

Flexible round, square, and rectangular spirals, fabricated in sizes ranging from 1/8-inch I.D. upward, lend themselves to a variety of practical and decorative uses. Gleaming metallic cord coverings enhance such house-hold appliances as toasters, coffee-makers, irons, and lamps. Spiro-Chrome also can be used for decorative handles, fashion accessories, book-bindings, and as trim for wrought iron ware and furniture.



Metallic extrusion for use as cord covering

Straight extrusions, whose core material is completely insulated by the plastic, offer many applications in the electrical field. Sizes and configurations are extruded to customer specifications.

Readers' Service tem P-8

Plastic Skin Coating

A protective coating for the face, hands, and arms of workers in the plastics and chemical industries has been introduced by the Milburn Co. Called Ply No. 9 Gel, the compound consists of an aqueous dispersion of a plasticized, film-forming polymer which is insoluble in anhydrous organic chemicals. It is supplied in the form of a soft, transparent gel packed in a six-ounce tube.

When applied to the skin, the water base evaporates to leave a thin, invisible, and flexible film. This plastic film-barrier has

been found impervious to epoxies, polyesters, amines, styrenes, phenols, vinyl plasticizers, coal tars, and most organic solvents. It is attacked only by acetone, methyl alcohol, and ethyl alcohol. Water-soluble, it is not recommended against water-based irritants.

Ply No. 9 Gel is air permeable, thus permitting the skin to breathe. A special ingredient in the gel, Milbex, prevents spotting or corroding of highly finished metals due to acid perspiration and other moisture.

Readers' Service Item P-9

Phenolic-Bonded Nylon Pads

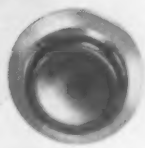
A new type of pad for removing smashed insects, road film, and oil from auto windshields and bodies has been introduced by the Livingston Co. Fabricated from Nylabond padding, a combination of nylon fibers bonded with Bakelite's phenolic resin, the pads are moistened and used with mild soap or detergent. Stronger soap solutions permit the removal of black curb marks from white sidewall tires.

Two sizes are available at automotive retail outlets: the smaller Spook Bug Remover Pad, and the larger Car Wash Mitt. The latter has Nylabond padding on one side for the hard-to-remove dirt, and fluffy synthetic fibers on the other side for ordinary washing. Both the pad and the mitt can be used as polish applicators. Nylabond padding is a product of Gustin-Bacon Mfg. Co.

Spook pad readily cleans white sidewalls.

Readers' Service Item P-10

In this Pushbutton World



it's important for manufacturers

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of quality phenolics—

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PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

New Literature

Write item numbers on Readers' Service card to obtain copies.

"The Aging Properties of Kralastic." Naugatuck Chemical Div., United States Rubber Co. 9 pages. With the aid of charts and graphs, this bulletin summarizes the physical properties of Kralastic compounds in several colors that have been aged in the weatherometer for 5,000 hours and Florida-aged for more than two years.

Readers' Service Item L-1

"Hendrick Panel Saw." Hendrick Mfg. Corp. 6 pages. This illustrated brochure describes the Models MA and MLR saws for cutting large plastic sheet stocks, both manually and automatically.

Readers' Service Item L-2

"Fabrication Data of 'Cadco' Extruded Acrylic Sheets." Cadillac Plastic & Chemical Co. 12 pages. This bulletin contains complete information on handling, machining, forming, cementing, and annealing of Cadco extruded acrylic sheets. Included is a table of properties, four pages of light-transmittance charts, and a comparison with cast sheet.

Readers' Service Item L-3

"Autoforms." Guy P. Harvey & Son Corp. 4 pages. Engineered for operation in the Formaton-C automatic injection molding machine, the molds feature a built-in hydraulic cylinder and unscrewing device. Mold shoes may be reused continuously, with only the cavities and cores requiring changing.

Readers' Service Item L-4

"Two-Ounce Automatic Formatons." Guy P. Harvey & Son Corp. 4 pages. Machine operation is explained diagrammatically, and specifications are listed.

Readers' Service Item L-5

"Combination Automatic Formatons." Guy P. Harvey & Son Corp. 4 pages. The Formation-C principle is explained in a series of diagrams and pictures. Specifications and optional equipment are listed.

Readers' Service Item L-6

"Three-Ounce Formatons." Guy P. Harvey & Son Corp. 4 pages. Specifications and dimensions are listed, and diagrams of the machine's operation and platen lay-out are included.

Readers' Service Item L-7

"Sonite 2000 Series for Encapsulating." Technical Bulletin 18. Smooth-On Mfg. Co. 2 pages Physical and electrical properties of these filled epoxy resins are listed, along with suggestions for their use in encapsulation.

Readers' Service Item L-8

"Forrest Carbide-Tipped Saws." Forrest Mfg. Co., Inc. 8 pages. This illustrated bulletin describes seven types of saw blades used in industry: conventional ripsaw, mitre, groover, plastics, graphic arts, split saws, and metal.

Readers' Service Item L-9

"What You Should Know about Flexible Pipe Made of Tenite Polyethylene." Eastman Chemical Products, Inc. 6 pages. This folder describes the environmental stress cracking and weathering resistance of Tenite polyethylene pipe used for conveying cold water.

Readers' Service Item L-10

"Plio-Tuf P100 for Injection Molding." 56-65A. Chemical division, Goodyear Tire & Rubber Co., Inc. 2 pages. Physical and electrical properties, chemical resistance, effect of recycling, and exposure resistance of this high-impact, styrene resin are in this bulletin.

Readers' Service Item L-11

"Effect of Chemicals on Plio-Tuf P100." 56-151. Chemical division, Goodyear Tire & Rubber Co., Inc. 1 page. Results of ASTM immersion test D-543-52T are described.

Readers' Service Item L-12

"Hopper-Dryer and Automatic Jet Hopper Loader." Thoreson-McCosh, Inc. 4 pages. This illustrated bulletin describes the action of the two machines in both injection molding and extrusion. Specifications are listed.

Readers' Service Item L-13

"Standard Mold Bases and Moldmakers' Supplies." Detroit Mold Engineering Co. 170 pages. All prices and specifications in this catalog are effective as of June 1, 1957. Among the many items included herein are abrasives, applicator guns, ball-end mills, backing plates, clamp plates, compression molds, dowel pins, ejector boxes, mold bases, platens, sprue bushings, and milling cutters. Numerous illustrations are included, plus tables of engineering data.

Readers' Service Item L-14

"The 'PE' Series." Technical Bulletin 220. Claremont Pigment Dispersion Corp. 6 pages. Complete specifications and stability data are given for this series of granular color concentrates, used in coloring polyethylene.

Readers' Service Item L-15

"Zytel Offers Unique Properties for Use in the Design of Bearings." A-1507 Polychemicals department, E. I. du Pont de Nemours & Co., Inc. 8 pages. Properties are tabulated, and finished part are described and illustrated in this bulletin.

Readers' Service Item L-16

"Molded Zytel Parts on a Complicated Linotype Machine Improve Performance, Cut Costs." A-1506. Polychemicals department, E. I. du Pont de Nemours & Co., Inc. 8 pages. Molded nylon gears, control knob, sprockets, assembly star, matrix buffer, and stop sleeves are described and illustrated. Advantages are pointed out, along with information on the material's moldability.

Readers' Service Item L-17

"Injection Molding of Plio-Tuf P100." 56-57. Chemical division, Goodyear Tire & Rubber Co., Inc. 2 pages. Molding equipment and conditions are described, along with variations, problems and solutions, and case histories.

Readers' Service Item L-18

"Finishing and Lacquering of Plio-Tuf P100." 56-68. Chemical division, Goodyear Tire & Rubber Co., Inc. 1 page. The finishing operation is described in some detail, and a list of manufacturers preparing suitable lacquers is included.

Readers' Service Item L-19

"Designing with Plaskon Plastics & Resins." Barrett division, Allied Chemical & Dye Corp. 4 pages. The firm's Plaskon ureas, melamines, and polyester resins are described in this four-color bulletin. Partial lists of properties are included.

Readers' Service Item L-20

"Pfaudler Glassed-Steel Polymerizers for Processing Synthetic Resins." Bulletin 932. Pfaudler Co. 8 pages. This illustrated bulletin outlines the latest advances and accessories available in its line of glassed-steel polymerizers. Standard designs are rated for temperatures up to 350° F., with internal pressures from full vacuum up to 150-200 psi., coincident with 80 psi. jacket pressure.

Readers' Service Item L-21

New Literature (Cont'd.)

"IMS Catalog of Injection Molding Accessory Plant Equipment." 1957 Edition. Injection Molders Supply Co. 50 pages. Presentation is confined primarily to standard stock items such as grinders, drum tumblers, mounting pads, material conveyors, mold temperature indicators, heat circulators, mold releases, gate cutters, purgers, magnets, and drying ovens.

Readers' Service Item L-22

"Plastics in the Furniture Industry." Study #3. Plastics division, Monsanto Chemical Co. 16 pages. This consumer survey on bedroom furniture drawers features basic statistics which point toward wider adoption of Lustrex styrene drawers for case goods. One reason for the survey was the lack of standardization of drawer sizes throughout the furniture industry.

Readers' Service Item L-23

"Orangeburg SP Plastic Pipe." Catalog No. 401. Orangeburg Mfg. Co., Inc. 12 pages. Development, application, installation, and specifications of the pipe, made from a high-density polyethylene resin, are described in this bulletin. Working pressures, heat resistance, absence of pin holing, and chemical resistance are emphasized.

Readers' Service Item L-24

"Polyethylene Processing Tips." U. S. Industrial Chemicals Co. 9 pages. This illustrated file folder includes information on the selection of polyethylene resins for molding, extruding, electrical, film, coating, and specialty uses. Data on 12 Petrothene polyethylene resins are included.

Readers' Service Item L-25

"Aluminum Metalset A2 Series." Bulletin 11. Smooth-On Mfg. Co. 4 pages. Uses, advantages, mixing, curing, and machinability of these aluminum-filled epoxy compounds are described and illustrated. Curing agents are enumerated.

Readers' Service Item L-26

"Coatings Parade." Vol. 1, No. 1. Bakelite Co. 12 pages. The illustrated periodical describes the marketing of surface coating resins, new applications, and recent developments in the field. Bakelite supplies epoxy, vinyl, and phenolic resins for use in coatings formulations.

Readers' Service Item L-27

"Fisher Polyethylene Ware." Bulletin FS-268. Fisher Scientific Co. 8 pages. This illustrated catalog covers everything from one-ounce vials to 13-gallon carboys; and includes such other items as graduated cylinders, beakers, aspirator bottles, tubing, burette covers, funnels, and test tubes.

Readers' Service Item L-28

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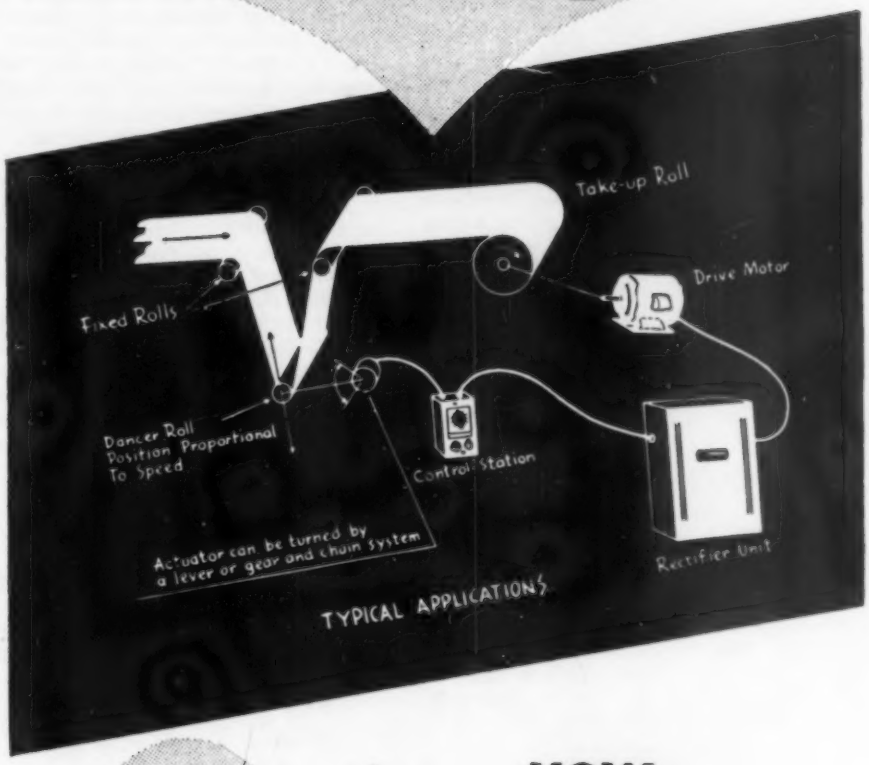

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New Literature (Cont'd.)

"Comet Sheet Plastic-Forming Machines." Comet Industries. 8 pages. Specifications and dimensions are given for a number of the firm's vacuum-type and drape-forming machines. Several applications of these techniques are illustrated.

Readers' Service Item L-29

"Mirenda Valves, Fittings, & Pumps." Mirenda Corp. 4 pages. This illustrated catalog lists specifications and prices for the firm's line of PVC valves and fittings.

Readers' Service Item L-30

"Basic Concepts of Acrylic Emulsion Paint Technology." Gerould Allyn, Rohm & Haas Co. 12 pages. Based on a series of lectures given by Mr. Allyn at the University of Florida, the booklet summarizes the development of water-thinned paints, the technology of acrylic emulsions, acrylic paint formulations, manufacture of acrylic paints, equipment used, properties, and application to various types of surfaces.

Readers' Service Item L-31

"Detroit Chrome-Cobalt, High-Speed Steel Router Bits." Bulletin RB-56. Detroit Tap & Tool Co. 4 pages. Specifications and prices are listed for the 1/16-2 inch diameter, straight fluted bits, and the spiral fluted bits from 1/8-3/4 inch in diameter. All have straight shanks, with either single or double ends.

Readers' Service Item L-32

"New Kensol Heavy-Duty Roll Leaf-Stamping Equipment." Olsenmark Corp. 4 pages. Specifications are listed for the Kensol 50, 60, and 110 presses, along with descriptions of special attachments and feeding devices.

Readers' Service Item L-33

"New Horizons for Epon Resins." Shell Chemical Corp. 20 pages. Along with a general description of the materials are photographs and diagrams showing how duplicate patterns are built.

Readers' Service Item L-34

"Properties Chart—Epibond Adhesives and Epocast Pastes." Furane Plastics, Inc. 1 page. This 11- by 15-inch chart lists properties, formulations, bond resistance, and typical applications for nine Epibond adhesives, three Epocast pastes, and two Furane adhesives.

Readers' Service Item L-35

"How a Profitable Plant Was Built around a Daring Processing Concept." Badger Mfg. Co. 8 pages. This brochure illustrates and describes the styrene plant this company designed and built for Cosden Petroleum Corp. The plant recovers ethylbenzene directly from gasoline, and combines same with mixed xylenes to produce styrene.

Readers' Service Item L-36

"General Catalog of High-Vacuum Equipment for Laboratory and Industrial Applications." Bulletin 1-1. Rochester division, consolidated Electro-dynamics Corp. 24 pages. High-vacuum pumps, evapor-ion pumps, Heraeus root pumps, rotary oil-sealed mechanical pumps, valves, baffles, traps, high-vacuum gages, leak detectors, stills, high-vacuum metallizing equipment, and high-vacuum furnaces are described and illustrated in this bulletin.

Readers' Service Item L-37

"Cellobond AX.2660 Polyester Resin for Specially Heat Stable Laminates." Inf. Sheet No. P104. British Resin Products, Ltd. 12 pages. Properties, compounding, reinforcement, methods of use, choice of catalyst, fillers, cured properties, and flexural strength of laminates of this medium-viscosity resin are given in this bulletin.

Readers' Service Item L-38

"Cellobond AX.2623 General Purpose Polyester Resin." Inf. Sheet No. P105. British Resin Products, Ltd. 11 pages. Complete information on compounding, cure, resin and laminate properties are contained in this bulletin.

Readers' Service Item L-39

"Cellobond AX.2652 General Purpose Thixotropic Polyester Resin." Inf. Sheet No. P106. British Resin Products, Ltd. 10 pages. This bulletin lists full information on this thixotropic resin used for horizontal surface work.

Readers' Service Item L-40

"Cellobond J.2782 Plywood Adhesive Resin." Inf. Sheet No. XA101. British Resin Products, Ltd. 3 pages. Mixing, storage life, and applications of this water-soluble phenolic resin are given in this bulletin.

Readers' Service Item L-41

"Cellobond J.2781 Adhesive Resin for Chipboard." Inf. Sheet No. XA102. British Resin Products, Ltd. 3 pages. Preparation, storage life, methods of use, pressing conditions, and cleaning of tools after using this water-soluble phenolic resin are described in this bulletin.

Readers' Service Item L-42

"Industrial Coated Fabrics." A-2116. Fabrics division, E. I. du Pont de Nemours & Co., Inc. 8 pages. Five methods of molding complicated shapes out of plywood, laminated glass, and resin-saturated fabrics using Fairprene synthetic-elastomer curing bag and blanket materials are described in this bulletin. Techniques for laying out, cutting, and cementing the molding bag are illustrated.

Readers' Service Item L-43

"What Every Manufacturer of Reinforced-Plastic Products Should Know about Garan Woven Roving." L.O.F. Glass Fibers Co. 8 pages. This illustrated, three-color brochure describes the woven fabric, which is produced from parallel glass fibers. Applications range from tooling fixtures and inboard cruisers to swimming pools and pipes.

Readers' Service Item L-44

"The Rheology of Plastisols." By Arnold C. Werner. Naugatuck Chemical, division of U. S. Rubber Co. 22 pages. This is a revised copy, with diagrams, of a paper presented by Mr. Werner at the seventh conference of film, sheeting, and coated fabrics division of the Society of the Plastics Industry.

Readers' Service Item L-45

"Emersol Stearic Acids." Emery Industries, Inc. 24 pages. Designed to aid in the selection of the proper grade of stearic acid for each end use, this brochure discusses physical properties, interprets test data, and gives composition tables on the various grades.

Readers' Service Item L-46

"Products." Air Reduction Chemical Co. 4 pages. The bulletin summarizes physical properties and applications of the firm's products, including vinyl monomers, acetylenic alcohols, glycols and hydrocarbons, ditertiary glycols, and non-ionic surfactants.

Readers' Service Item L-47

"GRC Injection Molded Tiny Plastic Parts." Gries Reproducer Corp. 4 pages. This bulletin describes approximate dimensional and weight limits for small molded parts, particularly nylon. A design engineers' check list is included.

Readers' Service Item L-48

"New Plastics Molding Facilities." Penn Plastics Inc. 4 pages. The illustrated brochure outlines the firm's facilities for compression, injection, and transfer molding; low pressure reinforced casting; and other equipment for plastics fabrication. Also pictured are representative products, custom molded from a variety of materials.

Readers' Service Item L-49

Book Reviews

"La Stabilisation des Chlorures de Polyvinyle," (The Stabilization of PVC). Fernand Chevassus and Roger de Broutelles. Les Editions Amphora, 119 Avenue Parmentier, Paris XI, France. Vinylite, 6¼ by 9¾ inches, 332 pages. Price, 3,500 francs (approx. $10.15), plus postage.

Covering both the theoretical and the practical viewpoints, this work is intended to aid the technologist not only in selecting the proper stabilizer for a given purpose, but also to help him understand the mechanisms of stabilization against heat and light degradation.

Part I consists of three chapters covering the following topics: the structure of PVC, the functions of stabilizers, and photodegradation. Part II lists stabilizers according to their chemical composition, describes their use, and discusses stabilizer combinations and synergistic phenomena. The first two chapters of Part III deal with testing, and with the influence of plasticizers, fillers, etc., on the final formulations. Five succeeding chapters deal with specific applications in the fields of electrical insulation, calendered products, rigid materials, plastisol and organosol formulations, and paints and varnishes.

References and patents are included at the end of each chapter. Commercial stabilizers available in the United States and abroad are listed under their trade names, and arranged by manufacturer.

"Investigation of the Effects of Molecular Weight, Chain Branching, and Irradiation on Polyethylene with Regard to Shelf Life in Bottles—Part 3." J. Pinsky, A. R. Nielsen, and J. H. Parliman, Plax Corp., for Wright Air Development Center. Order PB 121696 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 85 pages. Price, $2.25.

Four commercial polyethylenes were blow-molded into standard four-ounce, Boston-round Plax bottles. These samples were studied for the effects of higher molecular weight, side-chain branching, and irradiation by electron bombardment. Changes in permeability were tabulated; however, it was determined that packageability was not changed to an appreciable extent.

"Theoretical Investigation of the Effects of Molecular Weight, Side-Chain Branching and Irradiation on the Mechanism of Transfer of Materials through Polyethylene —Part 3, Supplement 1." H. A. Bent, University of Connecticut, and J. Pinsky, Plax Corp., for Wright Air Development Center. Order PB 121696-S from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 43 pages. Price, $1.25.

The permeability factors and absorption tests reported in Part 3 are analyzed and discussed, together with some data on aqueous solutions. The theory of mass transfer through polyethylene is expanded, and the results applied to data on carbon tetrachloride.

Chain branching and irradiation increase swelling coefficients and diffusion constants at low temperatures; decrease them at very high temperatures. Activated diffusion through polyethylene may induce structural changes similar to local melting. Frequency and P-factors increase with increased rigidity and mass of penetrant.

"Research on Shell Molding." Massachusetts Institute of Technology for Frankford Arsenal, U. S. Army. Order PB 121031 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 54 pages. Price, $1.50.

Ways for conserving the phenolic resins used as binders in shell molds for metal castings are described in this booklet. Recommendations for conserving the amount of resin used are based on scientific control of grain size and distribution of sand, particle packing, and surface preparation of the sand. Knowledge of the binding mechanism was gained through evaluation of various resins for shell strength.

"Survey of the Methods Used To Determine the Dynamic Mechanical Properties of Polymers." O. R. Abolafia, Picatinny Arsenal, U. S. Army. Order PB 121767 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 35 pages. Price, $1.00.

The results of a literature survey into the best methods for determining the dynamic mechanical behavior of polymers, or the mechanical properties of materials under sinusoidal stress or strain, are reported along with general theory on the subject. The best techniques were considered to be attenuation methods, resonance methods, and direct stress-strain methods. These methods are discussed with respect to ease of operation, degree of accuracy, and cost of instrumentation.

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Abstracts of Important Articles

Materials

"N,N'-Dimethyl-N,N'-dinitrosoterephthalamide Blowing Agent. Preparation, Properties, and General Applications. Preparation of Poly(vinyl Chloride) Foam at Atmospheric Pressure," M. F. Fuller, *Ind. Eng. Chem.*, 49, 4, 722 and 730 (April 1957).

The preparation and properties of this nitrogen-releasing compound are given in the first article, together with its applications for making unicellular expanded PVC, expanded vinyl plastisols, epoxy resin foams, and other expanded plastics. The second article describes a method of making slab stock foam, either batchwise or continuously; thick foams; cored foam; and foam formed on and bonded to various substrata, including vinyl sheet and fabrics, and miscellaneous molded items.

"Property-Structure Relationships in Polyethylene," G. N. B. Burch, G. B. Feild, F. H. McTigue, and H. M. Spurlin, *SPE J.*, 13, 5, 34 (May 1957).

A discussion of modifications in the Ziegler process which lead to polyethylenes of high linearity and narrow molecular-weight distribution, and to linear polymers within an increase in internal unsaturation.

"Thermal Conductivity of a Plastic Honeycomb Sandwich," Melvin Mark, *Modern Plastics*, 34, 9, 168 (May 1957).

Experimental data are given on thermal conductivity.

"Stabilization of Plastics," G. H. Taft, *Modern Plastics*, 34, 9, 170 (May 1957).

A discussion of degradation processes, stabilization factors, and stabilizing agents.

"Resin Emulsion Density-Solids Relationships," Leonard Shapiro, *Modern Plastics*, 34, 9, 180 (May 1957).

A discussion and depiction of a nomograph for calculating this relationship.

"Fatigue Properties of Fibrous Glass-Reinforced Plastics Laminates Subjected to Various Conditions," K. H. Boller, *Modern Plastics*, 34, 10, 163 (June 1957).

Fatigue strength data are presented for six standard and four heat-resistant laminates. Effects on fatigue strength are given for notching, moisture, fabrics, resins, mean stress levels, warp angles, and temperatures.

"Determination of Chlorine in Polymers and Copolymers of PVC," M. R. Lardera, *Mat. Plastiche*, 22, 10, 804 (Oct. 1956).

The method of determining chlorine in polymers and copolymers of PVC described is based on combustion of the polymeric substance in the pressure of platinum catalysts and in a stream of oxygen. The gaseous chlorine developed in the process is absorbed and transformed into chlorine ions by an oxidizing solution, and the ions are titrated by the potentiometric or Volhard volumetric method. The simple apparatus used for the procedure, which is said to be rapid and accurate, is described and its manner of application. (In Italian).

"Studies on the Aging of Plastics. I. Investigation on the Scatter of Values for Tear Resistance and Strain in Foils," K. Thinius and J. Schreiber, *Plaste u. Kautschuk*, 3, 9, 198 (Sept. 1956).

A large number of thickness, tear resistance, and strain measurements were carried out on samples of plastic foils to determine whether scatter in values obtained was due to aging effects or to structural differences in the materials. Rigid and plasticized PVC, polycaprolactam, and oriented polystyrene were examined. (In German).

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in September.

"Properties and Processing of Suspension Polymerized PVC—II," L. Kamphenkel, *Plaste u. Kautschuk*, 3 ,9, 209 (Sept. 1956).

The special characteristics which users of the suspension-polymerized PVC produced at Schkopau, East Germany, must take into account are considered with regard to stabilization (the material is marketed in unstabilized condition), and plasticization. Lead salts are found to be excellent stabilizers but, because of discoloration, are recommended mainly for use in cable making. A polymeric organic tin compound with a sulphur bridge is held to be ideal for colorless, transparent articles. Pastes cannot be formed from this resin, because plasticizer sprayed on the material at 100° C. is absorbed by the granules which do not cohere, so that the PVC-plasticizer mixture is free-flowing. Hints are given for satisfactory milling of this powder into sheet. (In German).

"Stabilizers for PVC Resins," E. Ferraris, *Materie Plastiche*, 22, 8, 675 (Aug. 1956).

The salts of magnesium, zinc, cadmium, mercury, boron, silicon, titanium, zirconium, thorium, and cesium are discussed, and relevant patents (Italian and others) are cited. (In Italian).

"Determination of Volatility and Migration of Simple and High Molecular Weight Plasticizers," A. Merz, *Kunststoffe*, 47, 2, 69 (Feb. 1957).

The method of determining volatility of plasticizers by the A.S.T.M. activated-carbon method (little known in Germany) and the ISO Draft Proposal TC 61/W.G. 6/13 are discussed and compared with the earlier air-stream method and, in particular, with a modified activated-carbon method used by the author in Switzerland. In the latter method, the individual test specimen (measuring 65 millimeters in diameter, instead of 50 mm. to facilitate calculations) is placed between two filter papers sealed at the edges. A series of paper-sealed specimens is placed in a metal vessel whose bottom, top, and specimen interlayers are filled with activated carbon. The vessel, which does not have air-tight closure, then goes into the heating cabinet. Measurements show the superiority of high molecular-weight plasticizers. In determining plasticizer migration, emphasis is placed on the composition of the contact material, and the use of high molecular-weight plasticizers in the barrier films serving to prevent plasticizer migration. It was found that suitably plasticized cellulose nitrate can be used for the barrier films. (In German).

"Some New Aspects of Polymer-to-Metal Bonding," N. Stuart, *Plastics* (*London*), 21, 230, 308 (Nov. 1956).

A report on some of the work now being undertaken on bonding of films by means of interference microscopy. The surface

phenomena discussed relate to rubber-to-brass bonding, but the findings suggest the possibility of bonding other polymers presently incapable of being bonded to metals by slightly modifying the original monomeric reaction system so as to incorporate a controlled, small percentage of a conjugated diene.

"Study of the Phenomenon of Impact—The Special Case of Lucoflex," J. Lesavre, *Ind. Plastiques Mod.*, 8, 7, 41 and 8, 8, 51 (July-Aug. & Sept.-Oct., 1956).

The present study on impact behavior of Lucoflex rigid PVC also aimed at discovering how best to express results of impact tests and how reliable are the apparatuses used in the Charpy and Izod tests. The results of a large number of tests were worked up statistically. It appeared that the phenomenon of impact is two-fold, according as a sample breaks freely or resists, and it was found desirable to express results of impact as fragility or impactance. Impactance (high level resistance) is the physical quantity measured in the case of non-rupture, and fragility is measured in the case of free fracture. Both the Charpy and Izod tests are very well adapted to determining impact resistance, and their results are of the same order. Although fragility cannot be measured very accurately yet, it is of practical importance, as it permits comparison of various materials and prediction of the energy absorbed by a bar of given dimensions. (In French).

"Coloring of Polyethylene," F. J. Hines, *Modern Plastics*, 34, 9, 168 (April 1957).

Coloring equipment, colorant properties, and heat stability of colorants are discussed.

"High Temperature Anhydride Cures," John Delmont, *Western Plastics*, 3, 11, 15 (Nov. 1956).

A detailed discussion of anhydride curing systems for epoxy resins, with emphasis on effect of material variations, post-curing, and application variables.

"Specifying Vinyls," W. Waychoff and P. Spink, *Materials & Methods*, 45, 1, 116 (Jan. 1957).

Realistic review of vinyl specifications showing what properties are obtainable, and which must be sacrificed for others in specific applications.

"'Zytel' Nylon Resin—A Versatile Engineering Material," W. C. Warriner and

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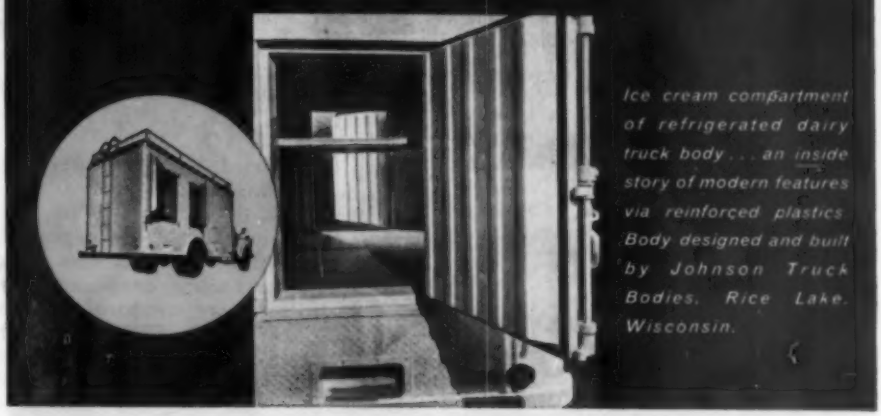
case: Dense, clean, strong, cold-stable, moisture-resistant plastic parts with ASP 400 filler



Ice cream compartment of refrigerated dairy truck body . . . an inside story of modern features via reinforced plastics. Body designed and built by Johnson Truck Bodies, Rice Lake, Wisconsin.

Filler Report: Customer uses high loadings of ASP 400—M & C's Aluminum Silicate Pigment filler—in formulations of epoxy and polyester resins and fiberglas to make roof tops, floors, and doors (including door panels, frames and steps) for bodies like the one shown here. Results:

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SERVICE AND STOCKS IN 30 CITIES

A. J. Cheney, *Mech. Eng.*, 78, 12, 1118 (Dec. 1956).

A discussion of engineering properties of Zytel, including specific gravity, and resistance to wear, abrasion, impact, weathering, chemical attack, and oxidation.

"Effect of Ratio of Diisocyanate Isomers in Polyurethane Foams," G. T. Gmitter and E. E. Gruber, *SPE J.*, 13, 1, 27 (Jan. 1957).

Isomer ratios are discussed in terms of foam formation and height, reaction complexity, fissures, and use of foam machines.

"Epoxy-Butadiene Resins," C. G. Fitzgerald, A. J. Carr, M. Maienthal, and P. J. Franklin, *SPE J.*, 13, 1, 22 (Jan. 1957).

Liquid polybutadiene was epoxidized with peracetic acid in chloroform solution, and a range of epoxy-butadiene resins prepared. Electrical properties of these resins are examined as functions of temperature and frequency.

"Production and Properties of Parallel Fiber Mats for Reinforced Plastics," W. Beyer, *Kunststoffe-Rundschau*, 3, 11 and 12, 405 (Nov. & Dec. 1956).

The factors on which the special qualities of parallel glass fiber mats depend are examined, with special reference to experience in the United States, and the requirements of consumers of these materials. (In German).

"Stabilizers for Vinyl Chloride Resins," E. Ferrari, *Mat. Plastiche*, 22, 11, 923 (Nov. 1956).

Derivatives of tin, especially organic tin compounds, are reviewed as stabilizers for PVC. Reference is made chiefly to American patents, but British, German, and French patents also are mentioned. (In Italian).

"Inert Fillers for Polyester Resins," P. Zanaboni and V. Maroni, *Mat Plastiche*, 22, 11, 884 (Nov. 1956).

The effects of calcium carbonate, kaolin, barytes, and whiting on the viscosity and stability of polyester resins are discussed, together with their help to reducing costs and improving physical properties. Tables are given to aid molders in selecting the most suitable types of fillers for specific purposes. (In Italian).

"Modified Polyamide Resins," G. Swann, *Trans. Plastics Inst.*, 25, 59, 56 (Jan. 1957).

The less known and so-far less important types of polyamides are considered. The production of polyamides is discussed in general, and Nylon 66 is used as an example of how different raw materials influence final properties. Next, the history of modified polyamides is reviewed, together with methods of modification, and the properties and applications of the products.

Processing

"Principles of Injection Molding of Thermoplastics," W. Eulitz, *Plastverarbeiter*, 7, 10, 377 (Oct. 1956).

The complicated heating processes in injection molding of thermoplastics can be traced back to relatively simple principles. The author shows the importance of the so-called surface factor, a direct measure of the cooling conditions when various structures are compared, and explains the relationship of this value to the average wall thickness of the injection molding. It is concluded that uniform wall-thickness and not the size of a molding, is decisive for the results to be expected from the injection molding process. A table gives the cooling period of various thermoplastics as functions of their surface factor or average wall thickness. (In German).

"Science and the Processing of Thermoplastics," J. v. Leeuwen, *Plastica*, 9, 11, 684 (Nov. 1956).

The relationship of processing and science is stressed to show manufacturers the possibilities science offers for the development of processing techniques, and also to interest scientists in this field. Fundamental research work on processing already has been started, mainly in the United States, but also in England and to some extent on the European continent. The author briefly reviews the present status of this research on the basis of available literature, concluding with a list of 60 references. (In Dutch).

Applications

"Engineering the Plastics House," A. G. H. Dietz, F. J. Heger, Jr., and F. J. McGarry, *SPE J.*, 13, 5, 38 (May 1957).

Some of the engineering details and material problems encountered with Monsanto's "House of Tomorrow" are described.

"Plastics Laminates Bonded to Other Materials," N. A. Skow, *Materials & Methods*, 45, 4, 118 (April 1957).

Applications described include plating rolls, shock-strut piston heads, precision bearing retainers, printed circuits, telephone relay spools, condenser seals, and circuit breaker bushings.

"Reinforced Plastics for Rocket Applications," G. Epstein, J. W. Eberhardt, J. Goldberg, and H. A. King, *Western Plastics*, 4, 5, 23 (May 1957).

Advantages and typical applications of reinforced plastics in rockets are described.

"Formed Cellulosics—Present Uses and Future Horizons for Packaging," W. M. Ronayne, *Western Plastics*, 4, 4, 18 (April 1957).

A discussion of present and potential uses for blister packages, skin packages, and containers.

"Plastic Laminate Heat Shields," J. G. Stanbury, *Modern Plastics*, 34, 10, 188 (June 1957).

How thin reflective coatings offer advantages over conventional insulating materials.

"Self-Expanding Thermoplastic Foam," D. L. Graham, *Materials & Methods*, 45, 4, 142 (April 1957).

A brief description of foamed-in-place polystyrene beads plus thermosetting resin, and its use in sandwich construction and other applications.

"Epoxy Coatings for Metal Products," R. E. Dunbar, *Materials & Methods*, 45, 4, 130 (April 1957).

The properties and uses of the six main types of coating formulations are given.

"Recent Trends in Photoelastic Plastics," M. M. Leven and R. C. Sampson, *Modern Plastics*, 34, 9, 151 (May 1957).

The use of plastics in photoelasticity is traced from Celluloid to the epoxies.

General

"Estimating for Reinforced Plastics," F. W. Sheffler, *Modern Plastics*, 34, 9, 135 (May 1957).

A description of the factors involved in proper estimating of costs for reinforced plastic parts.

"Technical Instruction," M. Sirtoli, *Mat. Plastiche*, 22, 10, 827 (Oct. 1956).

Technical training for the plastics industry is being provided by the state to three institutes in Rome, Milan, and Turin. The courses and programs of instruction are described in some detail. (In Italian).

Patent Digest

Materials

Production of Melamine. No. 2,776,285. Colver P. Dyer, Winchester, Mass. (to Monsanto Chemical Co., St., Louis, Mo.)

Molten urea is continuously injected into molten melamine contained in a stainless steel vessel under pressures from 700-10,000 psi., and temperatures from 370-550° C. The injection rate is sufficient to form a suspension of the urea that is out of contact with the walls of the vessel, and does not exceed 20%, by weight, of the total mass. The urea, and intermediate products formed therefrom, are maintained in suspension within the molten melamine until they are converted to melamine and gaseous by-products. A portion of the melamine is continuously removed at a rate sufficient to maintain the 20% weight ratio. Pressure is kept within the required limits, by controlling the amount of gaseous products released from the vessel.

Production of Melamine. No. 2,776,286. Alban J. Lobdell, Wakefield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.)

Molten urea is continuously mixed with molten melamine contained in a non-precious metal vessel at temperatures from 380-600° C., and at a minimum pressure of 1,000 psig. Vaporization and deamination of the melamine is kept at a minimum. A fluid suspension containing less than 30%, by weight, of the urea is formed so that it is out of contact with the walls of the vessel. The molten urea and its intermediate products are kept in suspension until converted to melamine and gaseous by-products. The molten melamine, which is the sole source of heat for the conversion of urea, is continuously withdrawn and a portion of the withdrawn material is heated and recycled to the vessel to maintain the defined operating temperatures, pressures, and weight ratio.

Continuous Process for the Polymerization of Acrylonitrile. No. 2,777,832. William Charles Mallison, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.)

Acrylonitrile with up to 15%, by weight, of a different monoethylenically—unsaturated compound that is copolymerizable therewith, is fed continuously into an agitated polymerization zone to be polymerized in the presence of a catalyst. The zone contains an aqueous polymer suspension having a monomer concentration from about 1-10%, and a substantially-constant quantity of polymer in the form of compact, rounded, discrete particles in an amount from 19-40%, by weight, of the suspension. The zone is maintained under a constant temperature between 20-70° C. The concentration of monomer in the feed is such as to maintain a constant amount of monomer and polymer within the zone.

High Pressure Polymerization Process for Ethylene-l-chloro-l-fluoroethylene Copolymers. No. 2,777,833. William R. Richards, Jr., Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.)

In the production of normally solid polymers by high-pressure polymerization of ethylene in aqueous media, 55-95 parts, by weight, of ethylene and from 45-5 parts, by weight, of l-chloro-l-fluoroethylene are subjected to copolymerization in the presence of at least 10 parts, by weight, of water at a temperature between 35-125° C. and a pressure of at least 5,000 psi. If l-chloro-l-fluoroethylene exceeds 25 parts, the pressure must be 20,000 psi. The process results in a recoverable, easily processed high copolymer.

Copolymerization of Vinyl Chloride With Vinylidene Chlorofluoride at High Pressures. No. 2,777,834. John D. Calfee, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.)

A monomeric material comprising 65-5%, by weight, of vinyl chloride and from 35-95%, by weight, of l-chloro-l-fluoroethylene is subject to copolymerization at a pressure of at least 20,000 psi. for a time sufficient to convert more than 60%, by weight, of the monomeric material to a normally solid, homogeneous, high molecular-weight coplymer.

Plasticizing Vinyl Resins. No. 2,779,743. Edmund H. Schwenke, New York, N. Y. (to Elastomer Chemical Corporation, Newark, N. J.).

Vinyl ester resins selected from the group consisting of polyvinyl chloride, a copolymer of vinyl chloride, and vinyl acetate are plasticized by melting aluminum stearate into dioctyl phthalate in the proportion of 1:5-10. Tricresyl phosphate is added to bring the mixture to the proportions of one part aluminum stearate to between 75 and 125 parts total plasticizer. Finally, one part resin is added for each parts plasticizer.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Polystyrene Phonograph Record Composition and Method of Making Same. No. 2,779,744. Frazier Groff, Plainfield, and Peter Bredgman Potter, South Plainfield, N. J. (to Union Carbide Corp., New York, N. Y.).

A resinous polystyrene composition suitable for molding sound records is prepared by milling sharp-edged particles of silicon carbide and boron carbide with sufficient polystyrene to hold the particles together and enable then to grind together until the sharp edges are dulled. A sufficient amount of polystyrene is milled-in to form a homogeneous composition containing up to 3.5 parts by weight of the dulled particles to 100 parts by weight of polystyrene.

Thermoplastic Composition Comprising Vinyl Chloride Polymer and Diolefin-Dialkyl Fumarate Copolymer. No. 2,779,748. Robert Snyder, Newark, N. J. (to United States Rubber Co., New York, N. Y.).

A rigid thermoplastic composition characterized by high impact strength, comprises and unplasticized, intimate fusion-blended mixture of from 3-24 parts of a rubbery copolymer having from 15-85% of a conjugated diolefin, 85-15% of a dialkyl fumarate, and from 97-76 parts of a vinyl chloride polymer.

Carbon Black Production. No. 2,779,664. Carl W. Sweitzer, Garden City, N.Y. (to Columbian Carbon Co., New York, N. Y.).

Separately-generated, oxidizing, combustion gases containing from 1-6% by volume of free oxygen are mixed rapidly and uniformly with the gaseous suspension of the furnace black at a reaction temperature of 1,200-2,200° F. Initial free oxygen concentration is set about 0.5-3% by volume.

Method for Producing Melamine. No. 2,778,828. Andre Claude Vislaron, Lannemezan, France. (to Societe des Produits Azotes, Paris, France).

A 50-80% aqueous solution of cyan derivative of ammonia is formed, dispersed in a confined area, and heated to 200-300° C. Pure melamine results.

Elastomers Derived from Polyisocyanate Modified Polyesters. No. 2,778,810. Erwin Mueller, Leverkusen-Bayerwerk, and Siegfried Petersen, Leverkusen-Schlebusch, Germany. (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany.

A dehydrated, linear polyester, having from 0.6-2.4% by weight of hydroxyl

groups, is reacted an excess of 190-600% of an organic polyisocyanate. The resulting isocyanate-modified polyester then is reacted with a diprimary aromatic diamine in a proportion to combine with at least one fourth of the isocyanate groups present.

Method of Imparting Flame-Resistance to Cellulosic Materials. No. 2,779,691. Anne MacMillan Loukomsky, North Plainfield, N. J. (to American Cyanamid Co., New York, N. Y.).

Fibrous cellulosic material is impregnated with an aqueous solution of a guanylmelamine salt. A pyrophosphoric acid or its salts is applied thus precipitating guanylmelamine pyrophosphate in finely divided form. The quantity of guanylmelamine so precipitated is within the range of 10-40% by weight of the fibrous cellulosic material.

Process for Producing Acrylonitrile. No. 2,778,847. Yoshisato Fujisaki, Kochi-shi, Kochi-ken, and Tsuyoshi Takemoto, Onorison, Toyada-gun, Hiroshima-ken, Japan. (to Asahi Kasei Kogyo Kabushiki Kaisha, Osaka, Japan).

Hydrogen cyanide and acetylene are introduced into an aqueous solution containing a dissolved catalyst derived from a cuprous halide and cuprous cyanide. The hydrogen cyanide and the acetylene then react to form acrylonitrile.

Equipment

Apparatus for Homogenizing and Kneading Plastic Masses. No. 2,779,054. Martin Doriat, Berghausen, Upper Bavaria, and Adolf Vogt, Munich, Germany. (to Wacker-Chemie G. m. b. H., Munich, Germany).

The apparatus comprises a rotatable, conical body and a closely adjacent conical sleeve forming a space of substantially uniform width, entirely open, and unobstructed at its greatest diameter. A plastic mass is introduced into the space between the body and the sleeve near the smaller diameter. Spaced ribs are provided on the rotatable body, which approximately fill the annular space and extend in the same general direction of the body's axis.

Extrusion Molding Apparatus. No. 2,779,970. Rudolf Stoecker, Coburg, Germany. (to Siemens-Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt and Erlangen, Germany.).

The apparatus consists of a stationary extrusion-head member having a conical, central opening. An extrusion nozzle, rotatably disposed within the opening, is coaxial with it, and has a conical surface complementary to, and sealingly engageable with the opening. Provision is made for rotating the nozzle which is axially and radially displaceable relative to the head member. A spring urges the extrusion nozzle against the conical opening of the head member so that a sealing is effected during rotation. The nozzle has an axial extrusion orifice, connected with the head member by a plurality of separate channels, for supplying the plastic material.

Apparatus for Shaping or Welding Thermoplastic Material. No. 2,778,919. Pierino Vicario, Cassano d'Adda, Italy. (to Gerd Lester, Chappaqua, N. Y.).

A portable air heater for shaping and welding thermoplastic materials consists of an electric blower; means for supporting the blower on the operator's body to allow free use of the hands; an electrical heater unit; a heat-insulated handle connected with the heater; a nozzle surrounding the heater and removably connected with the handle; a flexible hose connecting the blower with the handle; and an air chamber within the handle allowing passage of compressed air through the handle and out of the nozzle.

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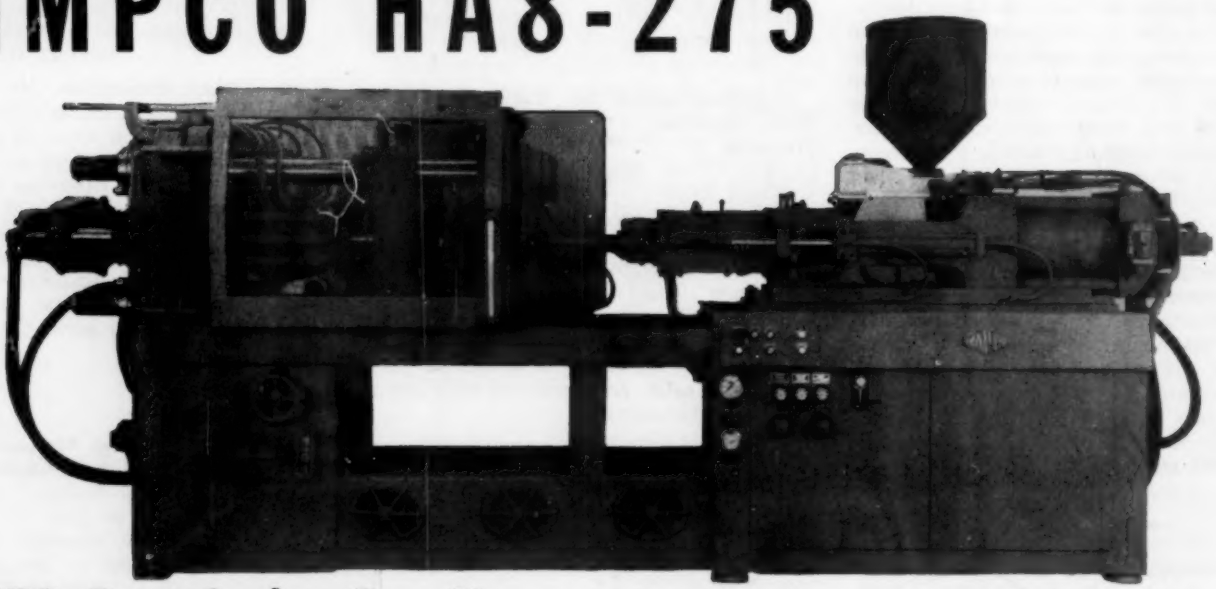

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Flow Tester for Plastic Materials. No. 2,780,096. Aubrey E. Noble, Plainfield, Charles F. Anness, Woodbridge, Joseph B. Hyman, Plainfield, and Robert W. Raetz, Westfield, N. J. (to Catalin Corp. of America, New York, N. Y.).

The device for measuring the flow characteristics of plastic materials comprises a rheometer tube with an orifice for holding a sample of the material to be tested. An electric unit heats the rheometer tube and sample to a predetermined temperature. Gas, under pressure, is applied to the softened plastic material, forcing it to extrude as a strand. The strand is cut off at predetermined intervals, and the rate of flow of the material is measured.

Treating Tank for Thermoplastic Materials and the Like. No. 2,778,922. Hugo E. Birkner, Jr., Kent, O. (to Sta-Warm Electric Co., Ravenna, O.).

The tank comprises a pair of vertically extending cylinders positioned one inside the other, and having coextensive axes. This provides for an annular material-receiving space. The bottom of the space is provided with a closure means, and the outer walls of the cylinders are heated. An agitator, composed of two sets of relatively narrow blades, is contained in the annular space. One set of blades is spiralled vertically adjacent the inner wall of the outer cylinder, while the other set occupies a similar position with respect to the outer wall of the inner cylinder. The blade-sets rotate in opposite directions.

Method and Apparatus for Continuously Stretching Plastic Film. No. 2,778,057. Stanley M. Clark, Parma, O.

The apparatus is designed for continuously stretching plastic film in a lateral direction, and consists of two pairs of cantilever-supported roller members arranged on opposite sides of the plastic sheet. The rollers have exposed flat end faces adapted to grip the edges of the sheet, driven in opposite directions about axes transverse to the plane of the film. This pulls the edges through diverging arcuate paths in the plane of the sheet.

Plastic Molding Machine. No. 2,778,-062. Ernest P. Moslo, Cleveland Heights, and Arthur H. Radde, Middlefield, O. (to Ernest P. Moslo, Cleveland Heights, O.)

The means for heating the plastic material includes two blocks meeting in a plane and extending from ram to nozzle end. A through passageway in the blocks, parrallel to—and adjacent to the plane, communicates with a plurality of narrow passageways extending radially outward. Provision is made for holding the blocks together.

Processing

Method and Apparatus for Making Bonded Fiberglass Shafts. No. 2,778,404. John M. Macy, South Bend, and Claude M. Rodgers, Mishawaka, Ind. (to South Bend Bait Co., South Bend, Ind.).

The fibers are withdrawn, at predetermined tension and in a downward direction, from a plurality of spools. They are guided in a converging relation, immersed in a container of resin and bunched to selected, close-spaced, parallel relation. Still moving downward, they are released to accommodate further wetting, rebunched and finally withdrawn from the bottom of the container where they are heated to cure the resin.

Production of Porous Shaped Articles True to Shape and Size from Synthetic Thermoplastic Materials. No. 2,779,062. Fritz Stastny, Weinheim an der Bergstrasse, Germany. (to Badische Anilin— & Soda-Fabrik Aktiengesellschaft, Ludwigshafen, Germany).

Porous shaped articles, true to size and shape, are made by heating small particles of a thermoplastic substance containing gases under pressure in a closed mold. The gases are allowed to escape while the thermoplastic is maintained at a temperature above its softening point. After expansion, the thermoplastic substance is cooled and a porous article is obtained.

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Applications

Plastic Dish with Cover Connection. No. 2,780,259. George S. Nalle, Jr., Austin, Texas.

A container assembly comprises a dish having side walls of stiff, flexible material that bows outwardly in response to internal pressure. The cover has grooves on the inside faces of its downwardly-extending sides which engage the flaring top edges of the sidewalks. Pressure in the internal surface of the sidewalls forces its top edges into the grooves of the cover.

Tamper Revealing Identification Card. No. 2,780,015. New Whitehead, San Juan, Puerto Rico.

A rectangularly shaped paper backing member is sealed thermoplastically between two cover members of transparent thermoplastic sheet material. The cover members are soluble in a certain substance. A colored ink, one of whose pigments is dissolvable in the substance, is used for printing information on the face of the backing member. The color of the ink will be changed discernibly by the dissolving of the second pigment upon application to the card of any of the solvents for the cover members.

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CALENDAR of COMING EVENTS

Sept. 17-18
Fourth meeting, Plastics Study Group, Building Research Inst. Washington U., St. Louis, Mo.

Sept. 18
SPE New York Section. Governor Clinton Hotel, New York, N. Y.

Sept. 25
Reinforced Plastics Group. SPE New York Section. Tufaro's Restaurant, Corona, L. I., N. Y.

Oct. 3
SPE Western New England Section. Terrace Rm., Bradley Field, Windsor Locks, Conn.

Oct. 4
SPE Southern California Section. Scully's Restaurant, Los Angeles, Calif.

Oct. 7-9
Paper-Plastics Conference, Technical Assoc. of the Pulp & Paper Industry. Sheraton-Gibson Hotel, Cincinnati, O.

Oct. 8
SPE Milwaukee Section. Bavarian Club, Milwaukee, Wisc.

Oct. 10-11
SPI annual New England Section Conference. Wentworth Hotel Portsmouth, N. H.

Oct. 11
SPE Connecticut Section. Hotel Barnum, Bridgeport, Conn.

Oct. 14
SPE Cleveland-Akron Section Spanish Tavern, Brecksville, O.

Oct. 16
SPE New York Section. Governor Clinton Hotel, New York, N. Y.

Oct. 17
SPE Pittsburgh Section. Cappy's Restaurant, Pittsburgh, Pa.

Oct. 21
SPE Upper Midwest Section Warwa's Cafe, Minneapolis, Minn.

Oct. 22
SPE Philadelphia Section. Franklin Inst., Philadelphia, Pa.

Oct. 23
SPE Quebec Section. Queen's Hotel, Montreal, P. Q., Canada

Oct. 30
Reinforced Plastics Group, SPE New York Section. Tufaro's Restaurant, Corona, L. I., N. Y.

Domestic Production and Sales of Plastics and Resin Material, February and March, 1957

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of February and March, 1957. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

March was a month of consistent gains, with all categories showing healthy increases. A comparison with March of last year, however, shows a similar picture. Gains over March, 1956, are evidenced in Styrenes, Vinyls, Coumarone-indenes, Polyesters, Polyethylene, and the miscellaneous category.

	February, 1957		March, 1957	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,483,744	1,462,267	1,899,375	1,770,363
Sheets, 0.003 gage and over	1,279,494	1,252,924	1,704,779	1,599,891
All other sheets, rods, and tubes	528,625	546,737	648,481	688,404
Molding and extrusion materials	7,186,777	7,040,799	8,095,247	7,885,620
Nitrocellulose sheets, rods, and tubes	429,089	350,892	378,827	359,233
Other cellulose plastics	374,656	330,597	500,369	448,476
TOTAL	11,282,385	10,984,216	13,227,078	12,751,987
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	15,448,355	14,363,909	17,860,884	14,225,481
Bonding and adhesive resins for—				
Laminating (except plywood)	4,733,850	3,659,132	5,594,690	3,746,589
Coated and bonded abrasives	1,534,146	1,307,289	1,513,483	1,472,404
Friction materials (brake linings, clutch facings, and similar materials)[2]				
Thermal insulation (fiber glass, rock wool)	3,978,184	3,830,952	3,970,446	4,139,330
Plywood	3,774,409	2,706,209	3,576,367	2,561,139
All other bonding and adhesive uses	4,028,718	3,632,541	4,166,653	3,840,624
Protective-coating resins, unmodified and modified except by rosin	2,669,902	2,024,221	2,625,173	2,420,249
Resins for all other uses	3,566,290	3,009,628	3,133,694	2,652,701
TOTAL	39,733,854	34,533,881	42,441,390	35,058,517
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,216,719	3,281,678	3,202,514	3,238,491
Paper-treating and Paper-coating resins	2,376,871	2,171,645	2,490,868	2,014,752
Bonding and adhesive resins for—				
Plywood	7,250,091	7,248,689	8,829,335	7,995,949
All other bonding and adhesive uses, including laminating	2,564,824	2,118,002	2,798,595	2,146,358
Protective-coating resins, straight and modified	2,836,442	2,126,599	3,307,771	2,837,058
Resins for all other uses, including molding	7,147,440	6,899,552	8,588,234	7,883,552
TOTAL	25,392,387	23,846,165	29,217,317	26,116,160
Styrene Resins:				
Molding materials[1]	33,446,376	31,783,278	37,369,266	37,448,043
Protective-coating resins, straight and modified	6,893,495	6,522,608	7,251,558	6,351,073
Resins for all other uses	12,650,240	9,593,468	13,671,964	11,696,117
TOTAL	52,990,111	47,899,354	58,292,788	55,495,233
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		8,669,487		8,589,219
Sheeting (resin content)		4,564,239		5,272,272
Molding and extrusion (resin content)		19,804,902		20,791,917
Textile and paper treating and coating (resin content)[3]		5,136,576		5,439,636
Flooring (resin content)		6,220,833		6,879,365
Protective coating (resin content)		2,681,788		2,798,246
All other uses. (resin content)		3,257,510		4,172,739
All other vinyl resins for—				
Adhesives (resin content)		3,255,313		3,371,907
All other uses (resin content)		9,528,941		10,060,258
TOTAL	64,004,784	63,119,589	70,418,716	67,375,569
Coumarone-Indene and Petroleum Polymer Resins	18,319,951	18,427,722	24,382,250	23,702,546
Polyester Resins	7,186,888	6,098,661	8,617,609	7,762,446
Polyethylene Resins	49,800,274	43,666,576	56,587,377	51,490,655
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1,4]	3,824,213	3,990,393	4,193,551	4,022,677
Protective-coating resins[5]	1,190,350	516,167	1,183,796	539,505
Resins for all other uses[6]	9,256,220	8,935,352	11,234,643	10,572,778
TOTAL	14,270,783	13,441,912	16,611,990	15,134,960
GRAND TOTALS	282,981,307	262,018,076	319,796,515	294,888,073

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

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Current Market Prices

This listing is as comprehensive and up-to-date as possible. The full listing will appear quarterly, while intervening issues will carry a briefer tabulation of price changes and additions.

Companies whose products do not appear are invited to submit price data for inclusion in the listing. All suppliers are requested to submit product additions and price changes promptly as they occur, in order to make this listing of maximum value to our readers.

Prices, in general, are f.o.b. works. Ranges indicate quantity or grade variations. No guarantee of these prices is made, and spot prices should be obtained from the individual suppliers.

— The Editor

Adhesives

Ampcoflex Adhesive	qt.	$2.75 / $3.50
Bakelite BC—17613	lb.	.54 / .84
BCU-40	lb.	.18 / .48
BR-11938	lb.	.285 / .585
Bonding resins, abrasives	lb.	.20 / .915
Brake linings	lb.	.215 / .6275
Foundry resins	lb.	.2075 / .395
Heat Insul. resins	lb.	.1425/ .37
CD Cement Nos. 200, 201, 202, 203, 204	qt.	.94 / 1.50
PS-7	qt.	2.12 / 2.90
Dow Corning C-271	lb.	1.64 / 1.89
Epon Adhesive VI, VIII, IX	lb.	3.08 / 3.30
	lb.	4.25 / 4.50
Epoxy Adhesive A-1, A-3, A-4	qt.	4.45 / 6.90
A-2, A-5	qt.	5.60 / 8.00
A-6	qt.	5.80 / 8.00
C-1, C-2, C-3, C-9	qt.	5.60 / 8.00
C-4, C-7	qt.	3.69 / 5.30
Flexible Resin No. 1	qt.	4.45 / 6.90
G-E 12316	lb.	.30 / .39
12353	lb.	.225 / .385
Melmac 401	lb.	.45
421	lb.	.45 / .47
Melurac 300, 302	lb.	.25 / .29
301	lb.	.28 / .33
Metlbond 2002-14	qt.	1.84 / 5.00
4021 Type I	sq. ft.	1.43
Type II	qt.	1.29 / 3.20
Type III	qt.	1.49 / 3.50
Plaskon Phenolic Bonding Resin	lb.	.16 / .21
Urea Adhesive 530-11L	lb.	.1875/ .2175
Liquid Adhesive, 2L Types	lb.	.105 / .115
WR Types	lb.	.0675/ .125
Spray Dried Adhesives	lb.	.18 / .29
Plastic Cement	gal.	2.25 / 2.70
Pliobond 20	gal.	4.50 / 7.00
30	gal.	5.25 / 8.00
Polyester Foam Cement PC-232	gal.	2.40 / 2.90
Schenectady SP-7401	lb.	.29 / .31
Schwartz Vinyl Cement	qt.	1.24 / 1.50
Synvarite US #1	lb.	.195 / .215
Synvarol T	lb.	.125 / .16
T-3	lb.	.0875/ .1225
T-15, T-15D	lb.	.1275/ .1625
TN, TUN	lb.	.1325/ .1675
TN-231	lb.	.14 / .175
WR-513	lb.	.0875/ .1225
WR-515	lb.	.0825/ .1175
WR-520	lb.	.0625/ .0925
Styrofoam Adhesive #5	gal.	3.75 / 4.75
Thixon CB	gal.	3.30 / 3.70
CB-2	gal.	3.75 / 3.95
IB	gal.	3.75 / 4.15
NB	gal.	4.05 / 4.45
NM-2	gal.	7.20 / 8.00
Urac 110	lb.	.205 / .225
115	lb.	.24 / .26
180	lb.	.095 / .12
185	lb.	.1625/ .2175
186	lb.	.0875/ .1125
192	lb.	.07

Anti-Static Agents

Anstac-2M	qt.	1.75 / 2.00
Logostat	gal.	1.35 / 1.65
Merix Anti-Static #79	qt.	.75 / 3.85
#79-OL	qt.	.75 / 3.85

Catalysts

Advance cobalt naphthenate 6%	lb.	.4825/ .5825
Cobalt tallate 6%	lb.	.4375/ .5375
Advacel	lb.	.4375/ .5375
Aritemp Curing Agent 105	lb.	2.00 / 2.25
Bakelite BH-17618	lb.	$0.33 / $0.63
BHU-53	lb.	.15 / .45
ERL series	lb.	.67 / 1.195
Cadet benzoyl peroxide, granules	lb.	.98 / 2.00
Paste	lb.	.95 / 2.25
Powder	lb.	1.50 / 2.37
Dichlorobenzoyl peroxide	lb.	3.00 / 4.25
Lauroyl peroxide	lb.	1.90 / 3.50
Methyl ethyl ketone peroxide	lb.	1.85 / 4.00
Catalyst 57	lb.	.12
196	lb.	.10
C-110, -180, -180-S, C-110-S, WF-100, -101	lb.	.12
Celanese accelerators D & E	lb.	.43 / .50
Benzol peroxide paste	lb.	2.00
Catalyst MC-1	lb.	2.25 / 2.50
Epon Curing Agent BF$_3$-400	lb.	4.00 / 4.50
C-111	lb.	.6225/ 1.10
D	lb.	3.33 / 4.75
T	lb.	.80 / 1.11
U	lb.	.86 / 1.02
Z	lb.	1.265 / 1.56
Furane H-736-A	lb.	1.30 / 2.00
Marblette Hardener 11	lb.	1.17 / 1.65
16, 661, 680	lb.	1.25 / 1.70
20	lb.	1.17 / 1.40
21	lb.	1.27 / 1.40
41, 665	lb.	1.32 / 1.77
175, 179	lb.	.50 / .65
645H	lb.	1.15 / 1.70
681, 901	lb.	1.20 / 1.80
900, 903	lb.	2.10 / 2.50
H C Promoter 6%	lb.	.5275/ .6275
12%	lb.	.9025/ 1.0025
Het anhydride	lb.	.55
HN 551	lb.	.95 / 1.40
901	lb.	.36 / .80
951 Ciba	lb.	.82 / 1.32
951 Furane	lb.	1.30 / 2.00
IC activators		3.00
Inhibitor	lb.	.98
Melurac 255, 259	lb.	.35
Modifier CB-110, WF-61	lb.	.15
P-27	gal.	10.00
Plaskon Hardeners, Liquid	lb.	.07
Powdered	lb.	.10 / .46
Spray dried	lb.	.10 / .25
Promoter D-2	lb.	1.60 / 2.00
Quick-Set Accelerator 804	gal.	9.80
Reichhold Hardeners 2600, 2601, 2602, 2603, 2604	lb.	.80 / 1.58
Rezolin epoxy hardeners	lb.	1.14 / 2.50
SA Hardener	lb.	.10
Soligen	lb.	.4825/ .5825

Coating Resins

Acryloids	lb.	.30 / .87
Amberlacs	lb.	.2625/ .2875
Amberols, phenolic types	lb.	.2125/ .375
Rosin maleic types	lb.	.21 / .345
Bakelite Phenolics	lb.	.28 / .64
Styrene emulsions	lb.	.1375/ .31
Vinyl acetates	lb.	.295 / .66
Solutions	gal.	5.10
Alcohols	gal.	2.27 / 2.76
Butyral resins	lb.	1.04 / 1.24
Chlorides	lb.	.41 / .61
Chloride-acetates	lb.	.38 / .66
Modified	lb.	.44 / .72
Celanese PVA emulsions, homopolymers	lb.	.17 / .26
Copolymers	lb.	.19 / .28
Chemigum latices	lb.	.46 / .60
Cymel 243-3	lb.	.38 / .385
245-8	lb.	.34 / .345
247-10	lb.	.385 / .39
248-8	lb.	.365 / .37
Dow Corning 805, 808	lb.	$1.54 / $1.65
806	lb.	1.85 / 1.98
840	lb.	1.52 / 1.73
Dylex K-500, -600, -700, -900	lb.	.30 / .46
G-E 13110	lb.	.30 / .39
Kel-F Dispersion (dry wt.)	lb.	12.00
Ladcote FHHF-4010, FYHF-4010	lb.	.3575/ .4075
Plaskon Alkyds	lb.	.1075/ .3375
Modified	lb.	.15 / .2625
Ester Gums	lb.	.1425/ .2475
Maleics	lb.	.1825/ .275
Melamines	lb.	.195 / .435
Phenolics	lb.	.3925/ .475
Modified	lb.	.1825/ .29
Phenolic Laminating Varnishes	lb.	.165 / .27
Silicone Alkyds	lb.	1.10 / 2.40
Ureas	lb.	.195 / .435
Pliolite latices	lb.	.30 / .39
Pliolite N R	lb.	.93 / 1.22
S-3	lb.	.42 / .44
S-5	lb.	.49 / .51
Milled	lb.	.54 / .56
S-7	lb.	.88 / 1.01
Polyfluoron liquid dispersions	lb.	2.65 / 3.85
Paste dispersions	lb.	4.20 / 4.40
Primer 140	qt.	7.88 / 8.25
Reichhold Coating Resins:		
Beckacite, floor covering	lb.	.2175/ .2575
Modified phenolic	lb.	.1975/ .2475
Non-phenolic	lb.	.215 / .3175
Super, pure phenolic	lb.	.2925/ .5825
Beckamine U-F	lb.	.1975/ .35
Super, melamine	lb.	.3275/ .3975
Beckolin	lb.	.2225/ .355
Beckopol	lb.	.2525/ .2625
Beckosol Solutions, epoxy esters	lb.	.37 / .40
Modified	lb.	.18 / .23
Non-phthalic	lb.	.16 / .2325
Phenolated	lb.	.16 / .2425
Pure-drying	lb.	.1525/ .28
Non-drying	lb.	.205 / .295
Super, isophthalic	lb.	.2075/ .3025
Epoxy resin	lb.	.595 / .6975
Hard resin solutions	lb.	.115 / .195
Hydrogum	lb.	.17 / .245
Kopol	lb.	.2675/ .2725
Pentacite, non-phenolic	lb.	.17 / .2425
Plyophen phenolics, alcohol-soluble	lb.	.17 / .725
Liquid resins	lb.	.165 / .20
Powdered	lb.	.30 / .325
Solution	lb.	.2575/ .2875
Water-soluble	lb.	.111 / .30
Resin emulsions, alkyd	lb.	.23 / .27
Wallpol	lb.	.17 / .23
Styresol	lb.	.2075/ .2475
Synthe-Copal	lb.	.1625/ .20
Wallkyd	lb.	.12 / .195
Schenectady Alkyds SA Type	lb.	.3575/ .38
SE Type	lb.	.3675/ 1.435
SEA Type	lb.	.3575/ .38
Styrenated	lb.	.22 / .2625
Maleics	lb.	.1725/ .23
Phenolics	lb.	.2325/ .53
Modified	lb.	.1825/ .275
Schwartz AT-25	qt.	.63 / 1.00
BK-40	gal.	3.80 / 3.95
Versamid 100	lb.	.51 / .69
L-115	lb.	.64 / .82

Colors

Acheson 0100 Series Paste Dispersions:		
Blacks	lb.	.50 / .81
Blues	lb.	.55 / 2.175
Green	lb.	2.51 / 2.69
Orange	lb.	.67 / .85
Reds	lb.	1.08 / 1.34
White	lb.	.52 / .70
Yellows	lb.	.57 / .75
Advabrite M-10	lb.	2.25 / 2.40
Advance Brightener M.D.A.C.	lb.	12.00 / 15.00
Akron Chemical Colors:		
Dry blends, reds	lb.	1.08 / 1.23
Yellows	lb.	.58 / .88
Organic colors, blues	lb.	.75 / 3.60
Greens	lb.	1.35 / 3.95
Reds	lb.	1.10 / 4.40
Yellows	lb.	2.00 / 5.00
Pastes, blues	lb.	1.25 / 1.58
Greens	lb.	1.85 / 1.90
Reds	lb.	1.10 / 1.40
White	lb.	.55 / .60
Yellows	lb.	1.70 / 1.75
Cabot carbon blacks:		
Black pearls 2	lb.	.70 / .78
71	lb.	.32 / .40
74	lb.	.24 / .32
81	lb.	.084 / .135
0	lb.	.12 / .19
Carbolac 2	lb.	.70 / .79
Elf 0	lb.	.12 / .19
Elftex 3, 5, 8	lb.	.085 / .135

Monarch 71	lb.	$0.32 /	$0.40
74	lb.	.24 /	.32
81	lb.	.095 /	.16
Sterling R	lb.	.0525/	.0925
S	lb.	.045 /	.0875
Supercarbovar	lb.	.47 /	.54
Cadmolith Reds	lb.	1.72 /	2.20
Yellows	lb.	1.12 /	1.20
California Ink, P. C. color dispersions:			
Black	lb.	.76 /	.77
Blues	lb.	.90 /	2.17
Brown	lb.	.56 /	.57
Green	lb.	2.05 /	2.06
Reds	lb.	.61 /	2.67
White	lb.	.72 /	.73
Yellows	lb.	.62 /	.74
P. C. plasticized boat colors:			
Black	lb.	.76 /	.77
Blue	lb.	1.32 /	1.33
Blue-green	lb.	1.21 /	1.22
Green	lb.	2.12 /	2.13
Red	lb.	2.69 /	2.70
Yellow	lb.	1.71 /	1.71
Claremont 4000-Series Pastes:			
Blacks	lb.	.82 /	1.01
Blue	lb.	.80	
Browns	lb.	.65 /	2.30
Greens	lb.	.80 /	2.15
Orange	lb.	1.58	
Reds	lb.	5.60 /	6.95
Silver	lb.	1.02	
White	lb.	.715	
Yellows	lb.	.65 /	2.87
D-Series pastes,			
Blacks	lb.	.48 /	.64
Blues	lb.	.62 /	1.57
Browns	lb.	.48 /	1.67
Golds	lb.	2.31 /	2.49
Green	lb.	1.78 /	1.88
Oranges	lb.	.71 /	4.27
Reds	lb.	1.10 /	6.36
Silver	lb.	.89 /	.91
Whites	lb.	.47 /	.60
Yellows	lb.	.56 /	3.70
K-Series pastes,			
Blacks	lb.	.56 /	.71
Blues	lb.	.89 /	1.40
Browns	lb.	.53 /	.55
Greens	lb.	.92 /	1.41
Metallics	lb.	.89 /	2.47
Orange	lb.	.86 /	4.45
Reds	lb.	.99 /	6.85
Violets	lb.	2.28 /	2.30
Whites	lb.	.59 /	.60
Yellows	lb.	.72 /	3.02
MB-Series inks:			
Black	lb.	.85	
Blue	lb.	1.25	
Clears	lb.	.65 /	.66
Green	lb.	1.30	
Metallics	lb.	1.20 /	1.25
Orange	lb.	1.05	
Pearl	lb.	1.17	
Red	lb.	1.11	
White	lb.	.68	
Yellows	lb.	.90 /	1.23
MY Series inks:			
Black	lb.	.70	
Blue	lb.	1.25	
Clears	lb.	.57 /	.62
Green	lb.	1.35	
Greengold	lb.	1.90	
Orange	lb.	.85	
Pearlescent	lb.	1.95	
Reds	lb.	1.15 /	2.95
White	lb.	.55	
Yellows	lb.	.75 /	1.35
Mylar printing inks:			
Aluminum	lb.	.99	
Black	lb.	.81	
Blue	lb.	1.18	
Bronze reducing clear	lb.	.51	
Gold concentrate	lb.	1.07	
Green	lb.	1.27	
Hi-viscosity clear	lb.	.69	
Orange	lb.	.97	
Pearlescent concentrate	lb.	1.98	
Red	lb.	1.19	
Reducing clear	lb.	.68	
White	lb.	.53	
Yellows	lb.	.83 /	1.21
PE-Series, granular concentrates:			
Blacks	lb.	.86 /	1.05
Blues	lb.	2.98	
Green	lb.	3.00	
Metallics	lb.	1.27 /	1.66
Oranges	lb.	1.12 /	2.75
Reds	lb.	1.93 /	5.25
Whites	lb.	.70 /	.85
Yellows	lb.	.78 /	5.10
PX-Series pastes:			
Black	lb.	1.58 /	1.68
Blue	lb.	2.50 /	2.60
Browns	lb.	1.08 /	1.47
Green	lb.	2.76 /	2.86
Grey	lb.	1.30 /	1.40
Ochre	lb.	1.27 /	1.37
Orange	lb.	1.48 /	1.58
Silver	lb.	1.45 /	1.55
White	lb.	.91 /	1.01
Yellows	lb.	1.58 /	2.55
RP-Series inks:			
Aluminum	lb.	$0.89	
Black	lb.	.58	
Blue	lb.	1.08	
Gold	lb.	.95	
Green	lb.	1.12	
Orange	lb.	.83	
Pearlescent	lb.	1.87	
Red	lb.	1.08	
Reducing clears	lb.	.47 /	.65
White	lb.	.49 /	
Yellows	lb.	.71 /	1.09
UR-Series pastes:			
Black	lb.	1.00	
Blue	lb.	1.82	
Brown	lb.	2.00	
Green	lb.	2.20	
Orange	lb.	1.68	
Reds	lb.	1.92 /	3.55
White	lb.	.83	
Yellows	lb.	1.75 /	2.15
VC-Series Inks:			
Black	lb.	.56	
Blue	lb.	.68 /	1.15
Clear	lb.	.39 /	.55
Green	lb.	1.155	
Metallics	lb.	.72 /	1.54
Orange	lb.	.68	
Pearl	lb.	1.96	
Red	lb.	1.17	
White	lb.	.37	
Yellows	lb.	.61	
Columbian Carbon colors:			
Aqueous dispersions			
Aquablak No. 1	lb.	.1925/	.1975
3	lb.	.125 /	.13
15	lb.	.115 /	.12
26	lb.	.1025/	.1125
41	lb.	.34 /	.345
B	lb.	.0975/	.1025
G	lb.	.12 /	.125
H	lb.	.20 /	.205
K	lb.	.12 /	.125
L	lb.	.14 /	.145
M	lb.	.105 /	.11
S	lb.	.1175/	.1225
U	lb.	.225 /	.23
X	lb.	.11 /	.115
Coloidex No. 3	lb.	.14 /	.21
No. 8	lb.	.16 /	.23
Hiblak AE	lb.	.095 /	.11
Colloidal dispersions			
Coacetateblak CQ-21	lb.	.875 /	.90
Coblac 405	lb.	.90 /	.925
DD Sol.	lbs.	.70 /	.725
Industrial	lbs.	.70 /	.725
Coethloblak CK	lb.	1.00 /	1.025
Coresinblak No. 3	lb.	.76 /	.785
Costvreneblak 903	lb.	.595 /	.62
CJ-21	lb.	.5425/	.5675
Covarnishblak AR	lb.	.60 /	.625
BK	lb.	.53 /	.555
BJ	lb.	.50 /	.525
Covinylblak BA	lb.	.95 /	.975
BD	lb.	.97 /	.995
BF	lb.	.70 /	.725
BH	lb.	.66 /	.685
BI	lb.	.82 /	.845
BM	lb.	.77 /	.795
CA-18	lb.	1.0725/	1.0975
Cowaxblak BV-25	lb.	.515 /	.54
CB-18	lb.	.5875/	.6125
CM-83	lb.	.485 /	.51
DC Globak	lb.	.77 /	.795
DCV Coblac	lb.	.83 /	.855
Manico colors, black	lb.	.1475/	.15
Browns	lb.	.1575/	.16
Crimsons, reds	lb.	.1425/	.145
Tans	lb.	.2325/	.235
Yellows	lb.	.12 /	.1275
Paint grades			
140	lb.	.1025/	.18
999	lb.	.26 /	.34
Excelsior	lb.	.135 /	.21
Molacco	lb.	.0625/	.12
Beads	lb.	.0575/	.115
Neo Spectra MK. I	lb.	.98 /	1.07
MK. II	lb.	.78 /	.87
MK. III	lb.	.47 /	.55
Ravens 11 & 15	lb.	.1025/	.18
Beads	lb.	.0775/	.17
Royal Spectra	lb.	1.66 /	1.78
Statex	lb.	.0725/	.13
Beads	lb.	.0625/	.12
Super Spectra	lb.	.70 /	.79
Superba	lb.	.36 /	.44
Continex HAF	lb.	.0725/	.13
SRF	lb.	.0525/	.11
Cyanamid inorganic pigments:			
Cobalt blues	lb.	.28 /	.35
Chrome greens	lb.	.42 /	.47
Oranges	lb.	.35	
Yellows	lb.	.35	
Iron blues	lb.	.54/	.59
Molybdate chrome oranges	lb.	.48	
Ultramarine blues	lb.	.19 /	.325
Zinc yellow	lb.	.29	
Powders, Unitane-O	lb.	.255 /	.265
Unitane-OR	lb.	.275 /	.285
Organic dyes, Indulines	lb.	.89 /	1.07
Nigrosines	lb.	.65 /	.94
Oil-soluble black	lb.	$0.68	
Blue	lb.	8.02	
Orange	lb.	1.06	
Reds	lb.	1.49 /	2.28
Yellows	lb.	1.21 /	4.16
Spirit-soluble black	lb.	2.95	
Brown	lb.	5.30	
Orange	lb.	5.87	
Red	lb.	6.41	
Yellows	lb.	4.62 /	4.94
Pigments, alkali blues	lb.	1.28 /	2.25
Benzidine oranges	lb.	3.15	
Yellows	lb.	.65 /	3.25
Bon reds	lb.	1.50 /	2.00
Carteret red	lb.	.93	
Chlorinated para reds	lb.	1.30	
Clarion orange	lb.	1.65	
Red	lb.	1.30	
Dinitraniline oranges	lb.	1.50	
Fugitive peacock-blue lakes	lb.	.90 /	1.17
Hansa yellows	lb.	2.20	
Lithol reds	lb.	.93 /	.98
Methyl violet toner	lb.	1.31	
Naphthol reds	lb.	.80 /	3.70
Orange lakes	lb.	.85 /	.90
PTMA blue	lb.	5.55	
Greens, Lincoln	lb.	5.30 /	6.60
Violet	lb.	4.35	
Para reds	lb.	1.15	
Phloxine toner	lb.	1.75	
Phthalocyanine blues	lb.	.90 /	4.20
Greens	lb.	3.50 /	3.95
Pigment green	lb.	1.35	
Scarlet	lb.	1.65	
Red Lake C's	lb.	1.20	
Madder	lb.	3.10	
Rhodamines	lb.	6.60	
Toluidine reds	lb.	1.70	
Yellow lakes	lb.	1.05 /	1.15
DC Globak	lb.	.77 /	.795
DCV Coblac	lb.	.83 /	.855
Eagle-Picher Basic carbonate White lead	lb.	.19 /	.20
Basic silicate, white lead			
201	lb.	.2075/	.2175
202	lb.	.20 /	.21
Litharge	lb.	.19	
Sublimed	lb.	.1910	
Ferro inorganic colors:			
Black	lb.	1.25 /	1.40
Blues	lb.	1.91 /	2.96
Blue-greens	lb.	1.85 /	2.85
Browns	lb.	.90 /	1.31
Oranges	lb.	2.29 /	4.20
Pink	lb.	1.77 /	1.92
Reds	lb.	2.96 /	4.75
Violets	lb.	1.89 /	2.37
Yellows	lb.	1.26 /	2.90
Harwick Stan-Tones, blues			
Dry	lb.	.90 /	3.45
GPE	lb.	2.50 /	2.85
MBS	lb.	2.20 /	4.55
PC	lb.	1.55 /	1.92
Brown, GPE	lb.	3.00	
PC	lb.	.60 /	.74
Greens, dry	lb.	.82 /	3.95
GPE	lb.	1.85 /	3.00
MBS	lb.	1.15 /	3.42
PC	lb.	1.70 /	2.32
Oranges, cadmium dry	lb.	2.10 /	5.05
Paste	lb.	2.52 /	3.32
GPE	lb.	1.20 /	1.27
MBS	lb.	1.25 /	2.82
PC	lb.	.75 /	.94
Reds, cadmium dry	lb.	2.26 /	6.15
Paste	lb.	3.25 /	4.05
Dry	lb.	.85 /	4.60
GPE	lb.	1.65 /	3.15
MBS	lb.	1.00 /	3.25
PC	lb.	1.02 /	1.52
Yellows, cadmium dry	lb.	2.80 /	3.18
Paste	lb.	1.79 /	2.21
Dry	lb.	.66 /	2.45
GPE	lb.	2.00 /	4.50
MBS	lb.	1.85 /	2.27
PC	lb.	.55 /	3.50
Hiblak AE	lb.	.095 /	.10
Interchemical IC Series			
Black	lb.	.56	
Blues	lb.	.75 /	2.10
Browns	lb.	.64 /	.69
Greens	lb.	.90 /	.99
Oranges	lb.	.78 /	.89
Reds	lb.	1.16 /	2.50
White	lb.	.70	
Yellows	lb.	.95 /	1.65
Kentucky inorganics, orange	lb.	.44 /	.64
Yellows	lb.	.31 /	.66
Organics,	lb.	3.00 /	4.15
Greens	lb.	3.50 /	4.60
Purple	lb.	1.85 /	2.05
Reds	lb.	1.95 /	3.85
Kriegr-O-Dip W Types	gl.	2.63 /	7.80
A Types	gl.	1.52 /	2.25
Laminac color pastes	lb.	.76 /	1.90
Mearlmaid Pearls	lb.	14.00 /	25.00
Nacromer Pearls, Series C	lb.	2.15 /	2.25
Series W	lb.	1.50 /	1.60
Pearl Essence, nat	lb.	15.00 /	30.00
Synthetic #100	lb.	1.95	
#300	lb.	1.45	
#600 #900	lb.	2.15 /	2.45

Plastics Color Co., GP colors:			
Blacks	lb.	$0.75 /	$3.80
Blues	lb.	.445 /	.48
Brown	lb.	1.20 /	2.25
Greens	lb.	.65 /	3.50
Reds	lb.	.65 /	3.50
Whites	lb.	.75 /	1.10
Yellows	lb.	1.15 /	1.95
Dispersant 3000	lb.	.50 /	.70
3005	lb.	.40 /	.60
3007	lb.	.80 /	1.00
3008	lb.	.55 /	.75
Polyester pastes, aqua	lb.	1.65	
Beige	lb.	1.45	
Black	lb.	1.10	
Blues	lb.	1.20 /	1.30
Brown	lb.	1.35	
Greens	lb.	1.20 /	1.70
Grey	lb.	1.30	
Ivory	lb.	1.30	
Oranges	lb.	1.80 /	2.05
Red	lb.	2.35	
White	lb.	.80	
Yellow	lb.	1.60	
Plolite S-5 bases with pigment			
Blacks	lb.	.44 /	.49
Blues	lb.	.62 /	1.48
Greens	lb.	.54 /	.58
Oranges	lb.	.61 /	.63
Reds	lb.	.31 /	1.20
Whites	lb.	.42 /	.44
Yellows	lb.	.43 /	.45
PMS polyester colors	lb.	.85 /	2.85
Polystyrene colors	lb.	.65 /	4.30
Polysupra polyethylene blues	lb.	.65 /	5.60
Blacks	lb.	.50 /	.80
Browns	lb.	1.48 /	3.30
Greens	lb.	1.82 /	3.55
Ivory	lb.	.65 /	1.00
Purples	lb.	2.10 /	3.30
Reds	lb.	.70 /	6.30
Silver	lb.	1.50 /	2.95
White	lb.	.60 /	.85
Yellow	lb.	1.45 /	4.25
Polystyrene blues	lb.	.50 /	9.20
Blacks	lb.	.50 /	5.30
Browns	lb.	.95 /	2.55
Greens	lb.	.35 /	7.40
Ivory	lb.	.85 /	1.20
Reds	lb.	.35 /	6.40
White	lb.	.60 /	1.05
Yellows	lb.	1.45 /	2.95
R-B-H Plastic Powders:			
Blacks	lb.	.66 /	.85
Blues, iron	lb.	.825 /	.925
Phthalocyanines	lb.	2.68 /	2.78
Browns	lb.	.56 /	.92
Greens, chrome	lb.	.805 /	.905
Phthalocyanines	lb.	2.29 /	2.39
Orange	lb.	.82 /	.92
Purple	lb.	2.95 /	3.05
Red	lb.	1.88 /	1.98
Whites	lb.	.66 /	.76
Yellow	lb.	.76 /	.86
Resin Plasticizer Pastes:			
Blacks	lb.	.56 /	.675
Blue	lb.	1.61 /	1.62
Green	lb.	1.60 /	1.61
Orange	lb.	.685 /	.695
Reds	lb.	1.19 /	2.15
White	lb.	.505 /	.515
Yellows, cadmium	lb.	1.22 /	1.23
Chrome	lb.	.565 /	.575
Vinyl Extrusion Chips:			
Blacks	lb.	.895 /	1.09
Blues, iron	lb.	.85 /	1.13
Phthalocyanine	lb.	2.45 /	2.55
Brown	lb.	.83 /	.93
Green, chrome	lb.	.91 /	1.01
Phthalocyanine	lb.	2.46 /	2.56
Oranges	lb.	.825 /	.97
Purple	lb.	3.36 /	3.46
Reds	lb.	1.65 /	2.07
White	lb.	.73 /	.83
Yellow	lb.	.795 /	.895
R-C blacks	lb.	5.50 /	21.30
Browns	lb.	4.375 /	15.75
Reds	lb.	.28 /	15.05
Yellows	lb.	3.60 /	14.05
Reichhold inorganic pigments:			
Blues, iron	lb.	.53	
Milori, pre-wet	lb.	.3625	
Greens, chrome	lb.	.42 /	.44
Reduced 25%	lb.	.19	
Oranges, chrome	lb.	.35	
Molybdate	lb.	.48	
Yellows, chrome	lb.	.35	
Zinc	lb.	.29 /	.34
Rez-N-Dye (dry wt.)	lb.	7.50	
Saran colors	lb.	.59 /	1.80
Sherwin-Williams Dispersed Colors	lb.	.55 /	1.97
Inorganic colors, oranges, yellows	lb.	.32 /	.45
Organic colors, blues	lb.	.90 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	.85 /	4.40
Yellows	lb.	.55 /	1.97
Vansul Organic Drys			
Blues	lb.	3.45 /	3.60
Greens	lb.	1.35 /	3.95
Oranges	lb.	2.21 /	3.00
Reds	lb.	.90 /	4.40
Yellows	lb.	2.00 /	2.25
VAP Dry Dispersions			
Black	lb.	1.00	
Blues	lb.	2.90 /	3.60
Greens	lb.	$3.20 /	$4.05
Oranges	lb.	1.45 /	2.55
Reds	lb.	1.70 /	4.45
Yellows	lb.	1.35 /	2.55
VP-Series Pastes			
Black	lb.	.70	
Blue	lb.	1.65	
Brown	lb.	1.55	
Green	lb.	2.05	
Oranges	lb.	.80 /	2.30
Reds	lb.	1.15 /	2.55
White	lb.	.47 /	.65
Yellows	lb.	.60 /	1.65
VPE-Series Pastes			
Black	lb.	.90	
Blue	lb.	1.85	
Green	lb.	2.10	
Orange	lb.	1.00	
Reds	lb.	1.45 /	2.30
White	lb.	.90	
Yellows	lb.	1.60 /	2.00
VY Chips			
Blacks	lb.	.90 /	1.30
Blues	lb.	1.00 /	2.25
Brown	lb.	1.60	
Greens	lb.	.90 /	2.45
Oranges	lb.	1.00 /	2.15
Reds	lb.	1.40 /	2.70
White	lb.	.65	
Yellows	lb.	.85 /	1.80
Vinylized colors, blacks, whites	lb.	.755	
Blues	lb.	1.16 /	1.18
Golds	lb.	1.51 /	1.57
Green	lb.	1.45	
Metallic	lb.	1.15	
Orange	lb.	.83	
Reds	lb.	1.15 /	2.27
Yellows	lb.	.76 /	1.09
Violite 199, green	lb.	2.95	
200, yellow	lb.	3.75	
PL 3-60, blue	lb.	3.25	
18-70, blue	lb.	3.70	
Williams colors & pigments:			
Blacks, iron oxide	lb.	.1425/	.145
Browns, iron oxide	lb.	.1525/	.155
Burnt umbers	lb.	.0775/	.095
Greens, chromium oxide	lb.	.42 /	.4875
Reds, 100 series, 1,000 series, RY series	lb.	.1375/	.14
Kromas	lb.	.1375/	.15
Yellows, iron oxide	lb.	.115 /	.1225
Witcoblak 12	lb.	.0725/	.14
32	lb.	.1225/	.20
50	lb.	.0975/	.175
100	lb.	.26 /	.34
Pellets	lb.	.26 /	.34
F-1	lb.	.0575/	.12
Hitone	lb.	.36 /	.44
Pellets	lb.	.36 /	.44
Zopaque, anatase	lb.	.225 /	.235
Rutile	lb.	.245 /	.255

Dispersing Agents

Daxads	lb.	.08 /	.40
Tamol 731	lb.	.185 /	.1875

Fillers

Advaresin CXF	lb.	.49 /	.55
KF	lb.	.38 /	.44
A. F. D.	ton	26.50 /	60.00
Albacar 5950, 5960, 5970	ton	50.00 /	55.00
Aluminum Flake	ton	23.50 /	30.00
Anhydrous calcium sulfate, W-1320	ton	47.00 /	52.00
Atomite	ton	32.50	
Barytes, No. 1	ton	45.00 /	65.75
Burgess Iceburg Pigment	ton	50.00	
Pigment No. 30	ton	37.00	
Cab-o-sil	lb.	0.68 /	0.75
Calcene NC	lb.	.036 /	.059
TM	lb.	.0375/	.0625
Camel—CARB	ton	12.00	
—TEX	ton	20.00	
—WITE	ton	32.50	
Cotton flocks	lb.	.12 /	.32
Crown Clay	ton	14.00	
Dixie Clay	ton	14.00 /	34.50
Duramite	ton	20.00	
English Mica:			
Waterground mica 160 mesh	lb.	.08 /	.0875
325 mesh	lb.	.0825/	.09
Georgia Kaolin clays:			
Hydrite	ton	26.00	
Flat	ton	25.00	
PD-10	ton	49.00	
PD-121	ton	20.00	
PX	ton	41.00	
Harwick fillers:			
Clays, Champion	ton	14.00 /	36.00
Harwick	ton	20.50 /	55.50
Flock, white	lb.	.11 /	.28
Colored	lb.	.11 /	.19
Magnesium carbonate	lb.	.105 /	.13
Magnesia, tech.	lb.	.055 /	.345
Mica, Silversheen	lb.	.08 /	.0875
Pecan shell flour	ton	45.00 /	106.00
Stan white 325	ton	11.50 /	23.50
Walnut shell flours:			
100W, 200WD	ton	$50.00 /	$60.00
200W	ton	60.00 /	70.00
200WB	ton	62.00 /	72.00
325W	ton	74.00 /	84.00
Hi-Sil 101	lb.	.10 /	.155
233	lb.	.09 /	.105
Kalite	ton	50.00 /	65.00
Kaolloid	ton	10.50	
Laminar	lb.	.015	
Maglite	lb.	.2525/	.26
Marinco	lb.	.105 /	.13
McMamee Clay	ton	13.50 /	33.00
Minerals & Chemical Corp.:			
Edgar ASP 200	ton	43.00	
ASP 400	ton	24.00	
ASP 600	ton	25.00	
ASP 900	ton	19.50	
ASP 1300	ton	80.00	
Multiflex MM	ton	110.00 /	125.00
Nytal 200L	ton	27.00 /	50.00
300	ton	37.00 /	60.00
Secco Clay	ton	12.00	
Silene EF	lb.	.06 /	.105
Sno-Brite Clay	ton	12.50	
Snowflake	ton	20.00	
Sparmite	ton	80.00 /	105.00
Surtex MM	ton	37.00 /	52.00
Suspenso	ton	33.00 /	48.00
Tamms Satin Talc	ton	22.50 /	46.00
Velveteen R Silica	ton	23.00 /	28.00
U.S. Mica, dry grind	lb.	.04 /	.065
Witcarb P	ton	110.00 /	140.00
R	ton	120.00 /	150.00
Regular	ton	56.75 /	85.00
Wollastonite F-1	ton	23.00 /	25.00
P-1	ton	25.00 /	27.00

Finishes

Logoquant colors	gal.	3.25 /	6.30
Toy gloss, acetate	gal.	2.35 /	4.30
Metal	gal.	2.45 /	4.10
Polystyrene	gal.	2.45 /	4.70

Flame-Proofing Agents

IC-776 Antimony Concentrate	lb.	.495 /	.51
M&T Antimony oxide	lb.	.27 /	.285

Glass Reinforcements

Chrome 60-end Roving:			
FBF-7.1, -7.3	lb.	.40 /	.44
FBF-7.5, -7.7	lb.	.42 /	.46
Garan 60-end Roving:			
FBF-7.2, -7.4	lb.	.42 /	.46
FBF-7.6, -7.8	lb.	.44 /	.48
Vitron 60-end Roving:			
VR-12	lb.	.48 /	.52

Lubricants

Advawax 280	lb.	.365 /	.39
Baselube	qt.	2.50 /	4.00
Dow Corning 7 Compound	lb.	5.30 /	6.50
20 Compound	lb.	1.74 /	4.95
20 Emulsion	lb.	.90 /	3.50
36 Emulsion	lb.	1.22 /	1.40
Mold Release Fluid	lb.	3.20 /	4.75
Garalease 915	gal.	3.80 /	4.50
GE silicone-emulsions	lb.	1.22 /	1.40
HSC #35, 362, 515	lb.	1.22	
IC-500	gal.	2.50	
-571	gal.	3.25	
-793-10	gal.	3.40	
IMS neutral oil spray	can	1.37 /	2.00
Lubrex	lb.	.27 /	.32
Lunn-Lease	gal.	4.15 /	4.85
M-1 Mold Release	lb.	3.00 /	4.00
Metasap barium stearate	lb.	.37 /	.42
Calcium 627	lb.	.36 /	.41
Stearate	lb.	.35 /	.40
Magnesium stearate	lb.	.38 /	.43
ML-4 Separating Film	lb.	.30 /	.40
Mold-Ease Concentrate PCR	qt.	2.50 /	5.85
Mold Release 225	gal.	5.25 /	6.00
235	gal.	6.00	
Mold-Wiz	gal.	4.00 /	6.00
Part-A-Part	gal.	3.05 /	3.75
Partingkote 823	qt.	1.18 /	2.18
Prepoxy	gal.	7.20 /	12.80
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Releasor Wax No. 826	lb.	2.29	
Slide	20 oz.	1.25 /	2.00
Sprits	lb.	1.00 /	1.25
SS-452	gal.	2.80 /	4.90
Super King Bomb-Lube	20 oz.	1.75 /	2.50
Toplube	qt.	2.50 /	4.00
Vibrin-VPA Parting Agent	gal.	4.25 /	4.65

Mica

Dry Ground Mica	lb.	$.04 /	$.065
Mycalex 385 & 400, rods, 18 in. length		.90 /	3.35
Sheets, 14 x 18 inches		5.70 /	22.40
K, rods, 18-in. length		1.80 /	6.70
Sheets, 14 x 18 inches		11.40 /	44.80
Supramica 500, rods, 18-in. length		1.08 /	4.02
Sheets, 14 x 18 inches		6.84 /	26.88
Waterground Mica	lb.	.08 /	.09

Miscellaneous

Dutch Boy Bentone	lb.	.44 /	.60
Ben-A-Gel	lb.	.98 /	1.40
Metasap Water Proofing Agent 569	lb.	.21	
PMS Purging Compound	lb.	.35	
Ultra violet absorber #9	lb.	5.25 /	5.75

Plasticizers

Adipol 2EH, 10A, 810, XX	lb.	.40 /	.435
BCA	lb.	.43 /	.455
ODY	lb.	.45 /	.465
Admex 710	lb.	.3325/	.36
711	lb.	.3525/	.38
744, 745	lb.	.3925/	.42
760	lb.	.5725/	.60
761	lb.	.4425/	.47
Akron MP	lb.	.305 /	.0755
Arnold-Hoffman butyl oleate	lb.	.20 /	.30
Butyl stearate	lb.	.2275/	.2675
Barrett dibutyl phthalate	lb.	.30 /	.335
Dimethyl phthalate	lb.	.28 /	.315
Plasticizer 136	lb.	.175 /	.21
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.32 /	.35
Cabflex DDA, DI-OA, DOA, ODA	lb.	.425 /	.455
DDP, Di-OP, DOP, ODP	lb.	.305 /	.335
Di-BA	lb.	.4325/	.4625
Di-OZ	lb.	.48 /	.51
HS-10	lb.	.44 /	.47
TCP	lb.	.345 /	.375
Chlorowax 40	lb.	.1525/	.1825
50	lb.	.1675/	.1875
70	lb.	.185 /	.25
70-S	lb.	.21 /	.275
LV	lb.	.1725/	.2025
Columbian Carbon butyl stearate	lb.	.2375/	.3275
Capryl alcohol	lb.	.195 /	.30
Caprylene	lb.	.10 /	.205
Dibenzyl sebacate	lb.	.92 /	1.01
Dibutyl phthalate	lb.	.30 /	.395
Dibutyl sebacate, CP	lb.	.665 /	.755
Dicapryl phthalate	lb.	.27 /	.36
Dihexyl adipate	lb.	.40 /	.495
Dihexyl phthalate	lb.	.30 /	.395
Dihexyl sebacate	lb.	.65 /	.74
Diisodecyl phthalate	lb.	.29 /	.385
Diisooctyl adipate	lb.	.40 /	.495
Diisooctyl phthalate	lb.	.28 /	.375
Diocyl adipate	lb.	.40 /	.495
Dioctyl phthalate	lb.	.28 /	.375
Dimethyl sebacate	lb.	1.30 /	1.39
Dioctyl sebacate	lb.	.60 /	.69
Harchemex	lb.	.24 /	.345
Harflex 300	lb.	.58 /	.675
325	lb.	.4325/	.52
500	lb.	.315 /	.41
Isooctyldecyl phthalate	lb.	.285 /	.38
Methyl ethyl ketone	lb.	.26 /	.365
Sebacic acid, CP	lb.	.77 /	.89
Purified	lb.	.69 /	.81
Conoco H-300	lb.	.06 /	.10
Darex DIBA	lb.	.4325/	.4625
DIBM	lb.	.32 /	.3475
DIBP	lb.	.30 /	.33
DODA, DIOA	lb.	.425 /	.455
DIDP, DIOP, DOP, DOP-HR, IOIDP	lb.	.305 /	.335
Dinopol 235	lb.	.335 /	.37
IDO	lb.	.285 /	.32
MOP	lb.	.31 /	.345
Dow Plasticizer No. 5	lb.	.315 /	.54
Resin 276-V2,-V9	lb.	.265 /	.325
Drapex 3.2	lb.	.40 /	.49
Drew DP-100, DP 200	lb.	.425 /	.46
DP-250	lb.	.435 /	.47
DP-316	lb.	.30 /	.335
DP-317	lb.	.5625/	.5975
DP-520	lb.	.4225/	.4575
SC	lb.	.44	
Dutch Boy Plasticizer NL-A10 (DBP)	lb.	.30	.33
NL-A20 (DOP), NL-A30 (DIOP)	lb.	.305 /	.335
NL-C20 (DOS)	lb.	.61 /	.63
NL-F21	lb.	.395 /	.425
NL-F31	lb.	.44 /	.47
NL-F41	lb.	.48 /	.51
NL-A54	lb.	.295 /	.325
Eastman di(2 ethyl hexyl) adipate, P.E.	lb.	.40 /	.435
Di (2 ethyl hexyl) azelate	lb.	.455 /	.49
Di-(2 ethyl hexyl) phthalate	lb.	.28 /	.315
Di(methoxy ethyl) phthalate	lb.	$0.425 /	$0.46
Diisobutyl adipate	lb.	.41 /	.445
Dibutyl phthalate	lb.	.30 /	.335
Diethyl phthalate	lb.	.275 /	.31
Diisobutyl phthalate	lb.	.29 /	.325
Dimethyl phthalate	lb.	.28 /	.315
Plasticizer 84	lb.	.27 /	.305
Triacetin	lb.	.365 /	.40
Tributyrin	lb.	.69	
Elastex 10-P, 28-P	lb.	.28 /	.315
18-P	lb.	.285 /	.32
20-A, 60-A	lb.	.40 /	.435
40-P, 48-P	lb.	.27 /	.305
50-B	lb.	.265 /	.30
80-P	lb.	.275 /	.31
90-P	lb.	.29 /	.325
DCHP, cast solid	lb.	.58 /	.59
Granular	lb.	.595 /	.605
Ethox	lb.	.50 /	.525
Flexol 3GH	lb.	.44 /	.46
3G0	lb.	.53 /	.55
4G0	lb.	.325 /	.35
8N8	lb.	.355 /	.38
10-10, 10-A	lb.	.29 /	.315
77-G, 426	lb.	.27 /	.295
380	lb.	.305 /	.33
810	lb.	.285 /	.31
A-26	lb.	.40 /	.425
B-400	lb.	.25 /	.275
CC-55	lb.	.305 /	.33
DOP	lb.	.28 /	.305
R2H	lb.	.59	
TOF	lb.	.43 /	.455
Flexricin 66	lb.	.3275	
P-4		.30	
P-6	lb.	.37	
P-8	lb.	.32	
Good-Rite GP-233, -235, -236	lb.	.40 /	.435
GP-261	lb.	.285 /	.32
GP-265	lb.	.29 /	.325
GP-266	lb.	.295 /	.33
Harflex 10	lb.	1.30 /	1.39
40	lb.	.665 /	.755
50	lb.	.60 /	.69
60	lb.	.65 /	.74
90	lb.	.92 /	1.01
120, 150	lb.	.28 /	.375
140, 160	lb.	.30 /	.395
180	lb.	.27 /	.36
220, 250, 260	lb.	.40 /	.495
300	lb.	.58 /	.675
325	lb.	.4325/	.52
500	lb.	.315 /	.41
Harchem butyl stearate	lb.	.2375/	.3275
Sebacic acid, CP	lb.	.77 /	.89
Purified	lb.	.69 /	.81
Kapsol	lb.	.33 /	.355
Kessoflex BCL	lb.	.365 /	.375
BCO	lb.	.355 /	.365
BCP	lb.	.33 /	.36
BCS	lb.	.305 /	.315
BO	lb.	.26 /	.28
BS	lb.	.235 /	.26
DBT	lb.	.64	
DDA, DIOA, DOA	lb.	.40 /	.435
DOZ	lb.	.46 /	.50
MCO	lb.	.3225/	.3525
MCP	lb.	.37 /	.40
MCS	lb.	.33 /	.34
ODA	lb.	.47 /	.50
TRA	lb.	.37 /	.40
KP-23	lb.	.29 /	.325
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.58 /	.59
-220	lb.	.32 /	.355
-555	lb.	.565 /	.57
Kronisol	lb.	.33 /	.365
Kronitex AA, I, K-3, MX	lb.	.325 /	.36
Methox	lb.	.385 /	.41
Monoplex DBS	lb.	.64 /	.665
DCP	lb.	.2925/	.32
DOS	lb.	.58 /	.605
S-38	lb.	.215 /	.24
S-70	lb.	.3925/	.42
S-71	lb.	.45 /	.475
Monsanto dibutyl phthalate	lb.	.30 /	.33
Diethyl phthalate	lb.	.25 /	.28
Dimethyl phthalate	lb.	.275 /	.305
Diphenyl phthalate	lb.	.5175/	.5375
DIDA, DOA	lb.	.425 /	.455
DIDP, DIOP, DOP	lb.	.305 /	.335
HB-20	lb.	.15 /	.17
HB-40	lb.	.22 /	.24
Orthonitrobiphenyl	lb.	.13 /	.15
Tricresyl phosphate	lb.	.325 /	.36
Triphenyl phosphate	lb.	.39 /	.40
Morflex P-50	lb.	.68 /	.71
Naugatuck decylbutyl phthalate	lb.	.27 /	.30
Dibutyl phthalate	lb.	.30 /	.33
Sebacate	lb.	.645 /	.67
Diisooctyl adipate, dioctyl adipate	lb.	.425 /	.455
Diisooctyl phthalate, dioctyl phthalate, Isooctyl decyl phthalate	lb.	.305 /	.335
Dinonyl adipate	lb.	.445 /	.475
Dioctyl sebacate	lb.	.585 /	.61
Epoxy plasticizer	lb.	.335 /	.36
Tricresyl phosphate	lb.	.345 /	.375
Ohio-Apex butyl oleate	lb.	.2325/	.265
Stearate	lb.	.22 /	.255
Diallyl phthalate	lb.	.49 /	.525
Dibutyl phthalate	lb.	.30 /	.335
Di-Carbitol phthalate	lb.	$0.40 /	$0.425
Diisobutyl adipate	lb.	.41 /	.445
Diisodecyl phthalate	lb.	.305 /	.34
Dioctyl phthalate	lb.	.305 /	.34
D.I.O.P.	lb.	.305 /	.34
Tributyl phosphate	lb.	.50 /	.535
Ohopex Q-10	lb.	.295 /	.33
R-9	lb.	.3525/	.3775
Paraplex S-B	lb.	.29 /	.3475
AL-111	lb.	.32 /	.3275
G-20	lb.	.76 /	.7675
G-25	lb.	.76 /	.77
G-40	lb.	.4825/	.51
G-50	lb.	.39 /	.4175
G-53	lb.	.4325/	.46
G-60, -61	lb.	.3325/	.36
G-62	lb.	.3525/	.38
RG-2	lb.	.41 /	.6575
RG-7	lb.	.33 /	.335
RG-8	lb.	.505 /	.5125
RG-10	lb.	.52 /	.5275
Pfizer acetyl tributyl citrate, tech	lb.	.32 /	.57
Acetyl triethyl citrate, tech.	lb.	.36 /	.57
Triethyl citrate	lb.	.4575/	.58
Plasticizer 1	lb.	1.17 /	1.37
Plasticizer 120	lb.	.44 /	.49
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
DBE	lb.	.50 /	.55
MGB	lb.	.29 /	.37
VS	lb.	.3575/	.3975
Plastolein 9050 DHZ	lb.	.52 /	.56
9055 DGP	lb.	.28 /	.32
9057 DIOZ	lb.	.455 /	.50
9058 DOZ	lb.	.455 /	.50
9250 THFO	lb.	.3575/	.4025
9404 TGP	lb.	.3725/	.4175
9715 & 9720 Polymeric	lb.	.365 /	.41
Polycizer 162, 562, 662	lb.	.285 /	.445
332, 532, 632	lb.	.40 /	.555
Polycon #7, 9, 10, 11	lb.	.305 /	.335
#30	lb.	.30 /	.33
#31	lb.	.27 /	.30
#40	lb.	.245 /	.275
PX-104	lb.	.30 /	.33
-108, -118, -120, -138	lb.	.305 /	.335
-114	lb.	.27 /	.30
-208, -220, -238	lb	.425 /	.455
-404	lb.	.645 /	.67
-438	lb.	.585 /	.61
-800	lb.	.325 /	.35
-917	lb.	.33 /	.36
Pycal 40	lb.	.3875/	.4375
60	lb.	.60 /	.655
62	lb.	.80 /	.835
94	lb.	.3275/	.3775
140	lb.	.35 /	.40
170	lb.	.275 /	.325
194	lb.	.2775/	.3275
RC Plasticizers:			
B-17	lb.	.21 /	.245
BD-8	lb.	.38 /	.4125
BIDP	lb.	.27 /	.305
DIDA, DIOA, DOA, ODA	lb.	.40 /	.435
DIDP	lb.	.29 /	.325
DIOP, DOP	lb.	.28 /	.315
DIOS, DOS	lb.	.60 /	.63
O-16	lb.	.275 /	.3075
ODP	lb.	.285 /	.32
TG-8	lb.	.3125/	.3425
TG-9	lb.	.41 /	.4425
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.325 /	.36
141	lb.	.34 /	.37
160	lb.	.25 /	.28
601	lb.	.32	
602	lb.	.305	
B-16	lb.	.4875/	.4975
E-15	lb.	.5075/	.5375
M-17	lb.	.4275/	.4575
Staflex AX	lb.	.43	
BR	lb.	.26 /	.29
CP	lb.	.28 /	.31
DBES, DOS	lb.	.61 /	.635
DIOA, ODA	lb.	.435 /	.465
DIOP, DOP, MP	lb.	.305 /	.335
DOZ	lb.	.48 /	.5075
IXA	lb.	.32 /	.35
KA	lb.	.36 /	.3875
KD	lb.	.44 /	.4675
Witcizer #100	lb.	.26 /	.27
#101	lb.	.31 /	.32
#200	lb.	.195 /	.205*
#201	lb.	.235 /	.245*
#300	lb.	.30 /	.33*
#312, 313	lb.	.305 /	.33*
#412	lb.	.435 /	.465*

Resins & Molding Compounds

Acrylic

Cadco cast rods	lb.	1.42 /	6.96
Polished	lb.	1.58 /	7.16
Machined rods	ft.	22.00 /	9.54
Tubes	lb.	1.39 /	5.76
Polished	lb.	1.51 /	5.99
Colors	lb.	1.62 /	5.99
Pearl	lb.	1.99 /	6.76

Lucite injection molding powders:			
Colorless, transparent	lb.	$0.55	
Std. colors	lb.	.59 /	1.00
Stock colors	lb.	.59 /	.84
Granular Powders for compression & extrusion	lb.	.51 /	.75
Plexiglas molding powders:			
Colorless	lb.	.55 /	.80
Colors, stock	lb.	.59 /	.84
Custom	lb.	.59 /	1.00
Sheets, Types I-A & II			
Colorless	sq. ft.	.80 /	22.18
Colors	sq. ft.	.88 /	1.10
Type R, Colorless	sq. ft.	.60 /	12.64
Colors	sq. ft.	.69 /	1.07
Type RL, colorless	sq. ft.	1.27 /	1.50
Colors	sq. ft.	1.52 /	1.80
Polycast 1	sq. ft.	80 /	2.40

Alkyd

Plaskon foundry resin 580-11L	lb.	.245 /	.275
Molding Compound,			
Type 411	lb.	.43 /	.60
Type 413, 417	lb.	.57 /	.74
Type 420 black	lb.	.44 /	.695
Type 422 colored	lb.	.51 /	.695
Mottle	lb.	.52 /	.705
Natural	lb.	.49 /	.60
Type 430	lb.	.34 /	.50

Cellulosic

Cellulose acetate:			
Celanese cast & extruded film:			
Standard length rolls, clear	lb.	.67 /	1.01
Colors	lb.	.93 /	1.19
Matte finish	lb.	1.43 /	1.77
Stock & cut sheets, clear	lb.	.033 /	.11
Colors	lb.	.044 /	.136
Matte finish	lb.	.087 /	.162
Celanese cast sheeting:			
Standard length rolls, clear	M. sq. in.	.129 /	1.47
Matte finish	M. sq. in.	.16 /	.657
Tinted	M. sq. in.	.243 /	.722
Stock & cut sheets, clear	M. sq. in.	.145 /	1.55
Matte finish	M. sq. in.	.183 /	.767
Tinted	M. sq. in.	.259 /	.862
Hercocel A, extrusion & injection	lb.	.50 /	.65
Injection, std. colors	lb.	.46 /	.61
Special colors	lb.	.42 /	.45
Lumarith molding compounds:			
Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III	lb.	.38 /	.48
Non-stock extruded rolls, clear	M. sq. in.	.13 /	1.28
Colors	M. sq. in.	.16 /	1.50
Extruded sheets, clear	M. sq. in.	.15 /	1.95
Colors	M. sq. in.	.17 /	2.13
Stock extruded rolls, clear	M. sq. in.	.13 /	.88
Colors	M. sq. in.	.16 /	.91
Extruded sheets, clear	M. sq. in.	.15 /	1.67
Colors	M. sq. in.	.17 /	1.67
Poly-Cell Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III	lb.	.38 /	.48
Group IV	lb.	.57 /	.66
Group V	lb.	.52 /	.61
Tenite Acetate, Group I	lb.	.50 /	.59
Group 2	lb.	.46 /	.55
Group 3	lb.	.41 /	.51
Group 4	lb.	.38 /	.49
Group 5	lb.	.65 /	.75
Cellulose acetate butyrate:			
Tenite butyrate	lb.	.62 /	.71
A pearls	lb.	.72 /	.81
Blacks, reprocessed	lb.	.50 /	.58
Cellulose propionate:			
Forticel	lb.	.63 /	.71
Essence pearls	lb.	.73 /	.81
Reprocessed blacks	lb.	.51 /	.58
Ethyl cellulose:			
Dyeform 720, 721	lb.	1.29 /	1.52
Ethocel PG	lb.	.72 /	.80
Bulk, reg.	lb.	.66 /	.81
Std., 7 cps.	lb.	.71 /	.86
Hercocel E	lb.	.72 /	.88

Epoxy

Araldite 502, 6010, 6020	lb.	.80 /	.995
504	lb.	.77 /	.965
551, 6060	lb.	.75 /	.95
6030, 6040	lb.	.885 /	.995
Bakelite ERL series	lb.	.80 /	.995
Epocast 2, 3, 5	lb.	$1.33 /	$1.77
4-B-2, 4-B, 4-C, 4-C-T, 4-D, Paste	lb.	1.09 /	1.15
Epon 562	lb.	1.52 /	1.77
815	lb.	.80 /	.99
820, 828	lb.	.80 /	.97
834	lb.	.855 /	1.00
864	lb.	.91 /	1.06
864-C-75	lb.	.73 /	.85
1001	lb.	.615 /	.85
1004	lb.	.595 /	.6025
1007	lb.	.605 /	.6125
1009	lb.	.69 /	.6975
Furane CN-502	lb.	1.33 /	1.77
Jet-Kote (with cat.)	gal.	7.50 /	10.00
Maraset 602, 610, 610V, 612B 613, 648	lb.	1.25 /	1.70
604A, 607	lb.	1.17 /	1.40
608	lb.	1.17 /	1.65
614A, 631A, 618A, 640	lb.	1.32 /	1.77
645	lb.	1.15 /	1.70
Reichhold Polytool Resins: 6125, 6130, 6140	lb.	.80 /	1.58
Rezolins A & B	lb.	1.29 /	1.74
Toolplastik packages:			
L-900, L-930	lb.	1.59 /	2.29
L-902	lb.	1.69 /	1.84
L-904	lb.	1.54 /	2.19
L-910	lb.	1.94 /	2.34
L-914	lb.	1.83 /	2.19
L-931	lb.	1.75 /	1.99
L-940	lb.	2.05 /	2.29

Fluorocarbon

Bakelite FGBB-33789, FGEB-34790, FXMA-50590, FXMB-50344	lb.	9.00 /	10.00
FGEB-32788, FXMB-50090	lb.	12.00 /	14.00
FYTD	lb.	11.00 /	13.00
FYTH, FYTS	lb.	8.50 /	9.50
Kel-F Grade 270, 300			
High density	lb.	6.50 /	9.00
Low density	lb.	6.00 /	8.50
Grade 300—P-25			
High density	lb.	7.50 /	10.00
Low density	lb.	7.00 /	9.50
Grade 500-F, 500-R			
High density	lb.	7.00 /	9.50
Low density	lb.	6.50 /	9.00
Polyfluoron, high density crystals & pellets	lb.	9.00 /	9.50
Colors	lb.	9.50 /	10.00
Low density powder	lb.	8.50 /	9.00
Dispersion grade	lb.	10.50 /	11.00
Teflon 1	lb.	4.50 /	5.55
5	lb.	4.75 /	5.80
6	lb.	7.45 /	8.00
30 aqueous dispersion	lb.	5.60 /	6.85

Melamines

Fiberite 2015 (black & pastels)	lb.	.57 /	.62
Pelleted	lb.	.61 /	.66
Cymel 402	lb.	.51 /	.53
404R, 404T	lb.	.85 /	.95
405	lb.	.45 /	.52
428	lb.	.48 /	.55
430	lb.	.465 /	.535
440	lb.	1.10	
480	lb.	.265 /	.315
1077, 1079	lb.	.45 /	.75
Ungranulated	lb.	.43 /	.73
1500	lb.	.42 /	.55
1502	lb.	.45 /	.58
3020	lb.	.57 /	.72
3024-A	lb.	.67	
3135	lb.	.85 /	1.05
3136	lb.	1.05 /	1.15
P-592, -592-A	lb.	.65 /	.75
Plaskon	lb.	.44 /	.75

Phenolic

91-LD	lb.	1.50 /	2.50
Admirez PL-50	lb.	.215	
UP-11	lb.	.2325	
Bakelite general purpose	lb.	.187 /	.3525
BMG-5000	lb.	.19 /	.30
Colors	lb.	.2375/	.435
Chem. resist.	lb.	.23 /	.40
Electrical Insul.	lb.	.2725/	.4125
Heat resist.	lb.	.19 /	.35
Impact resist.	lb.	.24 /	.4025
Barrett foundry resins, liquid	lb.	.2125/	.2425
Powdered	lb.	.27 /	.355
Insulation resins	lb.	.15 /	.175
Molding resin 313, 314, 317	lb.	.27 /	.285
316	lb.	.295 /	.31
1502, -3, -4, -5, R-110R	lb.	.25 /	.265
R-114	lb.	.285 /	.30
Corfoam 107, 114	lb.	.55 /	.82
Cyacor 151	lb.	.215 /	.235
191	lb.	.13 /	.16
Durez, heat resist.	lb.	$0.19 /	$0.245
Impact resist.	lb.	.24 /	.63
Insulation	lb.	.21 /	.305
Non-Bleed	lb.	.19 /	.195
Special	lb.	.19 /	.665
Std.	lb.	.19 /	.245
Durite GP	lb.	.195 /	.24
HR	lb.	.191 /	.3025
IM	lb.	.24 /	.415
SG	lb.	.195 /	.3575
Dyform	lb.	1.10 /	1.35
Fiberite 1078	lb.	.42 /	.43
1087, 1165, 1270, 1271, 1330, 1332, 1347, FM 1132, FM 3510	lb.	.39 /	.395
1153	lb.	.455 /	.46
1167	lb.	.3875/	.3925
1340	lb.	.4275/	.4325
1346	lb.	.44 /	.4475
4010	lb.	.68	
4020	lb.	.815 /	.82
FM 926	lb.	.43 /	.435
927	lb.	.41 /	.415
1914	lb.	.375 /	.38
1957	lb.	.445 /	.45
1996	lb.	.375 /	.38
10365	lb.	.5225/	.5275
11547	lb.	1.05 /	1.06
11678	lb.	.52 /	.525
14111	lb.	.415 /	.42
17067	lb.	.851 /	.82
17610	lb.	1.05 /	1.06
Fiberite 1078	lb.	.425 /	.435
1087, 1165, 1270, 1271, 1330, 1332, 1347, 1389, FM-1132, FM-3510, FM-3515	lb.	.395 /	.40
1153 (red only)	lb.	.46 /	.465
1167	lb.	.3925/	.3975
1333, FM-10365, FM-11678	lb.	.67 /	.675
1346, FM-927	lb.	.415 /	.42
1346 (red only)	lb.	.445 /	.452
4030-190	lb.	.78 /	.81
4031	lb.	.625 /	.63
FM-926	lb.	.435 /	.44
FM-1132 (pellets), FM-14111	lb.	.42 /	.425
FM-1914, FM-1996	lb.	.38 /	.385
FM-11547, FM-17610	lb.	1.07 /	1.08
FM-11679	lb.	1.29 /	1.30
FM-17067	lb.	.83 /	.835
G-E molding powders:			
12401	lb.	.31 /	.41
13408, 12486	lb.	.205 /	.215
12410, 12420	lb.	1.50 /	1.60
12432	lb.	.405 /	.505
12433	lb.	.565 /	.665
12435	lb.	.25 /	.35
12439-A, 12466	lb.	.265 /	.365
12444	lb.	.435 /	.535
12463	lb.	.415 /	.515
12467	lb.	.51 /	.61
12487, 12489, 12884, 12887	lb.	.365 /	.465
12491, 12493, 12853, 12900, 12901, 12902, 12920, 12921	lb.	.21 /	.31
12494	lb.	.385 /	.485
12808	lb.	.50 /	.60
12809	lb.	.66 /	.76
12871-A	lb.	.22 /	.32
12824	lb.	.505 /	.605
12841, 12906	lb.	.255 /	.355
Loven LHR-401, -403	lb.	.225 /	.23
-407, -409	lb.	.60 /	1.00
-408	lb.	.25 /	.255
LI-201	lb.	.39 /	.40
-207	lb.	.475 /	.48
-209	lb.	.60 /	1.00
-212	lb.	.425 /	.43
LM-110, -119	lb.	.19 /	.195
-101	lb.	.24 /	.245
-116	lb.	.255 /	.26
-117	lb.	.225 /	.23
-118	lb.	.1975/	.2025
LMI-301	lb.	.2525/	.2575
-303	lb.	.345 /	.35
-304	lb.	.60 /	1.00
-307	lb.	.3075/	.3125
LMM-801, -803	lb.	.2125/	.2175
-804, -811	lb.	.245 /	.25
-807	lb.	.215 /	.22
Marblette 76, 77	lb.	.50 /	.60
Foam resin 1076	lb.	.50 /	.60
Plenco foundry resins	lb.	.27 /	.35
Molding cmpds. gen. purpose	lb.	.185 /	.235
Heat resist.	lb.	.19 /	.24
Improved impact	lb.	.225 /	.28
Min. bleed	lb.	.185 /	.195
Radio & TV	lb.	.20 /	.215
Stock	lb.	.205 /	.34
Reichhold Foundry Resins:			
Corciment	lb.	.135 /	.17
Corovit	lb.	.275 /	.31
Foundrez, core binder liquids	lb.	.21 /	.25
Shell molding liquids	lb.	.195 /	.245
Powders	lb.	.2675/	.3025
Plyophen molding cmpds.:			
5440, 5596, 5655, 5660	lb.	.30 /	.325
5510, 5510-C	lb.	.34 /	.365
5657, 5658, 5661	lb.	.315 /	.34
Reilly general purpose	lb.	.195 /	20
Heat & impact resist.	lb.	.20 /	.205

Resinox molding compounds:			
Gen. purpose & heat resist	lb.	$0.205 /	$0.215
Impact	lb.	.255 /	.3225
Low elec. loss	lb.	.31 /	.365
Special grade	lb.	.215 /	.255
Rogers phenolic molding compounds:			
RX 425	lb.	.29 /	.295
Special colors	lb.	.34 /	.405
RX 428	lb.	.355 /	.36
Special colors	lb.	.42 /	.465
RX 429	lb.	.365 /	.37
Special colors	lb.	.395 /	.48
RX 431	lb.	.4125/	.4175
Special colors	lb.	.455 /	.55
RX 438	lb.	.4675/	.4725
RX 441, 455	lb.	.32 /	.325
RX 442	lb.	.3475/	.3525
RX 447	lb.	.5025/	.51
RX 448	lb.	.355 /	.36
RX 458	lb.	.38 /	.385
RX 469	lb.	.365 /	.37
RX 470, 480	lb.	.40 /	.405
RX 478, 488	lb.	.415 /	.43
RX 525, 545	lb.	.29 /	.295
RX 530	lb.	.4125/	.4175
Special colors	lb.	.42 /	.475
RX 547	lb.	.37 0	.375
RX 625	lb.	.395 /	.40
RX 628	lb.	.455 /	.46
Schenectady shell mold resins	lb.	.26 /	.28
Synvar molding compounds, PM series	lb.	.205 /	.2625
Synvaren 640	lb.	.30 /	.335
920	lb.	.21 /	.245
935	lb.	.195 /	.23
9203, 9203A	lb.	.173 /	.208
Synvaren liquid industrial resins:			
675	lb.	.29 /	.325
920	lb.	.21 /	.245
CP-66	lb.	.19 /	.225
PBL-2	lb.	.33 /	.365
PBL-218S	lb.	.27 /	.305
Synvarite GW-1000	lb.	.34 /	.36
GW-1080, PBL-F, PBL-718	lb.	.37 /	.39
GW-2400	lb.	.375 /	.395
PBL-100	lb.	.31 /	.33
PBL-108FF	lb.	.38 /	.40
PBL-210, PBL-3301	lb.	.36 /	.38
PBL-410	lb.	.33 /	.35
PBL-3311	lb.	.35 /	.37
PNL-12HL/11, PNL-156HL/24	lb.	.3025/	.3225
PNL-159H, PNL-169H	lb.	.29 /	.31
PNL-169PD, PNL-179PD	lb.	.28 /	.30
PNL-355PD	lb.	.315 /	.335
PNL-1279HL	lb.	.2875/	.3075
PT	lb.	.32 /	.34
Toolplastik No. 8000	lb.	.48 /	.72

Polyamide

Fiberfil Nylon G, natural	lb.	1.70 /	1.90
Standard colors	lb.	1.80 /	2.20
Nylatron G, GS	lb.	1.75 /	2.00
Plaskon 8200, 8201 natural	lb.	1.33 /	1.50
Black	lb.	1.53 /	1.70
White	lb.	1.43 /	1.60
Other colors	lb.	1.63 /	1.80
Spencer Nylon 400, 401, 402	lb.	1.33 /	1.50
60, 602	lb.	1.48 /	1.65
601	lb.	1.95 /	2.10
603, 604	lb.	1.83 /	2.00
Versamid 115	lb.	.64 /	.82
Zytel molding powder	lb.	1.435 /	1.60
Zytel, natural color	lb.	1.33 /	2.45
Blacks and whites	lb.	1.43 /	1.80
Colors	lb.	1.63 /	2.05

Polyesters

Acme 1-501	lb.	.82 /	.93
1-501A	lb.	.87 /	.98
1-503	lb.	2.75 /	3.50
1-510	lb.	.89 /	1.00
Atlac 363E-02Z, -12Z	lb.	.66 /	.69
-32Z	lb.	.68 /	.71
382E	lb.	.57 /	.60
FP	lb.	.66 /	.69
Bakelite Polyester resins	lb.	.35 /	.75
Diall 50-01	lb.	2.45	
50-51	lb.	3.25 /	3.50
50-52	lb.	3.50	
51-01	lb.	.87 /	1.15
52-01	lb.	2.25 /	2.50
52-20-30	lb.	1.50	
Diall 50-01, 50-51, 50-52	lb.	2.75 /	3.50
51-01	lb.	.87 /	.98
52-01	lb.	1.95 /	2.50
52-20-30	lb.	1.30 /	1.50
Fibercore 1000, 2000	lb.	.50 /	.65
3000	lb.	.55 /	.70
G-E polyesters			
AR 401	lb.	$0.35 /	$0.365
AR 403, 480	lb.	.34 /	.355
AR 403 LS, 480 LS	lb.	.355 /	.37
AR 493	lb.	.40 /	.415
AR 499	lb.	.435 /	.45
AR 501	lb.	.455 /	.47
Hetron	lb.	.43 /	.485
IC-312, -400, -514, -548, -625, -730, -800	lb.	.35 /	.385
-312-2	lb.	.365 /	.38
-336, -382, -706	lb.	.37 /	.385
-401	lb.	.44 /	.455
-420	lb.	.355 /	.37
-433	lb.	.38 /	.395
-636, -670	lb.	.48 /	.495
-638, -689	lb.	.55 /	.565
-670-2	lb.	.50 /	.515
-671	lb.	.405 /	.42
Filled resins	lb.	.255 /	.54
Laminac 4110	lb.	.33 /	.345
4111	lb.	.45 /	.465
4116	lb.	.33 /	.345
4120	lb.	.39 /	.405
4123, 4128	lb.	.34 /	.355
4134	lb.	.46 /	.475
4146	lb.	.43 /	.445
4192	lb.	.355 /	.37
4202	lb.	.55 /	.565
Marco resins:			
CEL-101, Marcothix 1, 3	lb.	.50 /	.515
Marcothix 5, 7, 8	lb.	.46 /	.475
Marcothix 9, MR-31C, -31V	lb.	.37 /	.385
Marcothix 10, MR-28C, -28V, -37C, -37CX	lb.	.33 /	.345
MR-28CS	lb.	.35 /	.365
MR-28H, -41R	lb.	.36 /	.375
MR-28R,-42R	lb.	.34 /	.355
MR-28RL, -37RL	lb.	.355 /	.37
MR-30C	lb.	.44 /	.455
MR-33C	lb.	.53 /	.545
MR-40R	lb.	.38 /	.395
MR-60C	lb.	.41 /	.425
MR-61H	lb.	.42 /	.435
Mylar, rolls, types A & C	lb.	2.50 /	4.80
Type D	lb.	3.00 /	3.30
Sheets, type A	M. sq. in.	.09 /	1.11
Type C	M. sq. in.	.09 /	.15
Type D	M. sq. in.	.53 /	1.34
Plaskon 911, 920	lb.	.55 /	.665
941, 942, 951, 9411	lb.	.35 /	.463
943	lb.	.41 /	.525
9404	lb.	.365 /	.48
9406	lb.	.355 /	.465
9500, 9510, 9511	lb.	.35 /	.465
9600	lb.	.44 /	.555
Pleogen 1000, 1001, 1002, 1006, 1007, 1100, 1810	lb.	.34 /	.355
1150, 1501	lb.	.365 /	.375
1201	lb.	.50 /	.51
1300, 1301	lb.	.35 /	.36
1300LS, 1700, 1813	lb.	.37 /	.38
1402	lb.	.44 /	.45
1406	lb.	.46 /	.47
1602	lb.	.35 /	.365
1800, 1802	lb.	.45 /	.46
Polycast 2	sq. ft.	1.89 /	5.18
3	sq. ft.	1.08 /	18.00
6	sq. ft.	.66 /	3.10
7	sq. ft.	.72 /	7.18
CR-39	sq. ft.	1.25 /	20.00
Polylite 8000, 8001, 8005, 8007, 8017, 8037, 8173, 8200	lb.	.34 /	.355
8006, 8008, 8009, 8039, 8166	lb.	.35 /	.365
8016, 8100	lb.	.365 /	.38
8050	lb.	.41 /	.425
8061, 8065	lb.	.44 /	.455
8120	lb.	.48 /	.495
8150	lb.	.45 /	.465
8170, 8237	lb.	.38 /	.395
8180, 8181	lb.	.36 /	.375
8400	lb.	.56 /	.575
Pre-Imp	lb.	.68 /	.85
Thermaflow 100, 200, 300	lb.	.48 /	.82
400, 500	lb.	.52 /	.87
1,000, 2,300	lb.	.34 /	.55
2,400	lb.	.36 /	.58
Vibrin 114, 117, 152, 154	lb.	.34	
115A	lb.	.38	
121	lb.	.46	
135	lb.	3.00	
142	lb.	.50	
151	lb.	.35	
152LS-4	lb.	.355	
153	lb.	.40	
X-1633-A	lb.	.49	
X-1636-W	lb.	.585	

Polyethylene

A-C No. 6, 617	lb.	.30 /	.37
No. 6A, 7, 617A	lb.	.35 /	.42
No. 615, G-201	lb.	.38 /	.45
No. 629	lb.	.40 /	.47
No. 729	lb.	.45 /	.52
Alathons, Group I	lb.	$0.35 /	$0.43
Group II	lb.	.37 /	.515
Group III	lb.	.375 /	.42
Bakelite DE Series	lb.	.43 /	.725
DYGT	lb.	.54 /	.69
DYLT, DYNF, DYNH	lb.	.41 /	.59
DYNJ	lb.	.44 /	.62
DYNK	lb.	.45 /	.63
Catalin 15-5	lb.	.41 /	.59
Celanese polyethylene sheeting:			
Extruded rolls, 44 in. wide	lb.	.56 /	1.12
Sheets, 44 x 60 in.	sheet	.83 /	8.76
Petrothene 100, 110, 200, 201, 202, 203, 210, 211, 213, 301, 312, 322	lb.	.41 /	.31
310, 320	lb.	.45 /	.55
310-BK-3, 320-BK-3, 320-BK-½, 320 colors	lb.	.53 /	.63
311, 321	lb.	.43 /	.53
311-BK-3, 312-BK-3, 322-BK-3 322-BN-1	lb	.375 /	.48
311-BK-½, 321-BK-3, 321-BK-½, 321-BN-1	lb.	.46 /	.56
321 colors	lb.	.50 /	.60
560	lb.	.38 /	.48
Poly-Eth 1007, 1008.5, 1408.5, 2007, 2206, 2215, 2235, 2236, 2256, 2405, 2425, 2455	lb.	.35 /	.49
Hi-D 1504, 1506, 2504	lb.	.42 /	.56
3215, 5005	lb.	.375 /	.515
3405	lb.	.38 /	.52
4005, 4225	lb.	.41 /	.55
4202, 5003, 5202	lb.	.51 /	.66
Reynolon 1000, P series	lb.	.60 /	.80
Rulan 2	lb.	.48 /	.52
Tenite Group 1	lb.	.41 /	.45
Group 2	lb.	.43 /	.47
Group 3	lb.	.46 /	.50
Group 4	lb.	.39 /	.43
Group 5, 6	lb.	.50 /	.77
Group 7	lb.	.60 /	.82
Group 8	lb.	.70 /	.92

Silicone

Bakelite GMGA-5001, -5002	lb.	2.75 /	3.10
5003	lb.	4.00 /	4.35
5004	lb.	5.40 /	5.75
Dow Corning 301	lb.	3.60 /	4.00
2103	lb.	1.55 /	1.65
2105, 2106	lb.	1.59 /	1.70

Styrenes

Ampacet, crystal	lb.	.315 /	.335
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	.75
Pearl	lb.	.41 /	.75
Phosphorescent	lb.	.695 /	1.00
Tinsel	lb.	.41 /	.67
Confetti	lb.	.51 /	.70
Bakelite BMC series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
BMS, SMD series, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	.52
RMD series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
TGD series	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
TMD series	lb.	.33 /	.40
Colors, std.	lb.	.36 /	.43
Special	lb.	.36 /	1.00
Catalin, high impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.36 /	1.00
Medium impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.355 /	1.00
Regular grade, crystal	lb.	.305 /	.325
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	1.00
Utility black	lb.	.18 /	.235
Cycolac compounds:			
Natural powders	lb.	.58 /	.66
Natural & std. color pellets	lb.	.65 /	.73
Special color pellets	lb.	.68 /	.76
Darex Copolymer 3	lb.	.47 /	.67
43G	lb.	.39 /	.58
X34	lb.	.42 /	.61
Latices 3L	lb.	.415 /	.56
610L	lb.	.30 /	.46
3020	lb.	.32 /	.47
Dow Latex, polystyrene	lb.	.30 /	.46
Latices, styrene/ Resins PS-2&3	lb.	.25 /	.35
butadiene	lb.	.30 /	.46
Dylite, expandable beads	lb.	.50 /	.60
Fiberfil Styrene G, natural	lb.	.55 /	1.00
Standard colors	lb.	.65 /	2.00
Koppers, Fibertuff	lb.	.55 /	1.505
MC-185 series	lb.	.33 /	.355
-300 series	lb.	.33 /	1.005
-400 series	lb.	.355 /	1.005
Regular, crystal	lb.	.295 /	.315

Colors, std.	lb.	$0.335 /	$0.355
Special	lb.	.335 /	1.005
Pearl	lb.	.41 /	1.005
Phosphorescent	lb.	.695 /	2.005
Kralastic, std. colors	lb.	.50 /	1.10
Lustrex Hi-Flows 55, 66, 77, & Hi-Heat 99, crystals	lb.	.275 /	.29
Colors	lb.	.315 /	1.00
Pearls	lb.	.37 /	1.055
Hi-Test, natural & black	lb.	.32 /	.34
Colors	lb.	.345 /	1.00
LHA, natural	lb.	.31 /	.325
Colors	lb.	.34 /	1.00
Utility black, gen. purpose	lb.	.205	
High impact	lb.	.26	
Medium impact	lb.	.215	
Marbon resins	lb.	.39 /	.46
Plio-Tuf C75, R100	lb.	.37 /	.45
G85	lb.	.52 /	.59
P100, std. colors	lb.	.41 /	.45
Polycast 4	sq. ft.	2.56 /	11.07
Styron 475, natural	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
Sheets, std.	lb.	.55 /	.60
Special	lb.	.55 /	.62
480, natural black	lb.	.38 /	.40
Colors, std.	lb.	.41 /	.43
Special	lb.	.41 /	1.00
647, crystal	lb.	.305 /	.32
Colors, special	lb.	.345 /	1.34
66, 688, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
700, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
777 colors, std.	lb.	.355 /	.375
Special	lb.	.355 /	1.00

Urea

Admirez Foundry Resins, SP-30	lb.	.27	
UP-50	lb.	.105	
Beetle C-4980 Brown	lb.	.1875/	.30
No fines granulation	lb.	.2075/	.32
T-298 Black	lb.	.1875/	.30
MUP series, powder	lb.	.30 /	.49
Special colors	lb.	.30 /	.59
Granules	lb.	.33 /	.52
Special colors	lb.	.33 /	.62
Foundrez core binder	lb.	.105 /	.14
Plaskon molding cmpds.:			
Black & Brown	lb.	.1875/	.30
Other colors	lb.	.30 /	.62
Foundry resins, liquid	lb.	.10 /	.13
Powdered	lb.	.2325/	.2525
Syplast molding cmpds., granules	lb.	.33	
Powder	lb.	.30	

Vinyls

Bakelite QG-5909	lb.	.35 /	.585
QG-5921	lb.	.41 /	.645
5924	lb.	.43 /	.665
QVNA, QVSM, QVSQ	lb.	.27 /	.47
QVNV	lb.	.30 /	.50
QVSJ	lb.	.28 /	.48
VG-1914, 1918	lb.	.37 /	.056
1985	lb.	.35 /	.585
5507	lb.	.31 /	.545
5544	lb.	.405 /	.64
5911	lb.	.315 /	.55
5980	lb.	.32 /	.555
7734	lb.	.28 /	.515
9031	lb.	.265 /	.50
9530	lb.	.275 /	.51
9960, 9970, 9980	lb.	.335 /	.57
VAGH	lb.	.55 /	.75
VMCH	lb.	.41 /	.61
VYDR, VYNW	lb.	.27 /	.47
VYHH	lb.	.32 /	.52
VYLF	lb.	.36 /	.56
VYNS	lb.	.44 /	.64
VYNV	lb.	.32 /	.52
Blacar No. BW-60	lb.	.315 /	.385
NEMA colors	lb.	.355 /	.425
No. BW-80	lb.	.405 /	.455
NEMA colors	lb.	.445 /	.495
No. PC white, ivory, black	lb.	.285 /	.335
Other colors	lb.	.325 /	.375
Darex Everplex A (wet wt.)	lb.	.21 /	.39
B (wet wt.)	lb.	.22 /	.40
G (wet wt.)	lb.	.21 /	.39
Copolymer V (wet wt.)	lb.	.245 /	.28
PVA Emulsions (wet wt.)	lb.	.19 /	.355
Diamond PVC-45, -50	lb.	.27 /	.33
Dow PVC-100, -111	lb.	.38 /	.57
Exon 402A, 500, 905, 915, 925	lb.	.31 /	.51
450, 468R, 480	lb.	.35 /	.55
461	lb.	9.75	
468	lb.	.33 /	.53
470	lb.	.55	
471	lb.	.50	
654	lb.	.34 /	.54
Formvar	lb.	.865 /	1.03
Gelva emulsions	lb.	.19 /	.205
Granules	lb.	.4175/	.617
Geon 101, 101EP, 103EP, 202	lb.	.27 /	.45
121	lb.	.30 /	.48
126	lb.	.28 /	.46
400X110	lb.	.41 /	.59
404H1	lb.	.37 /	.55
409, 426, 427, 428	lb.	$0.32 /	$0.50
503H (polyblend)	lb.	.425 /	.525
2042, 2046	lb.	.315 /	.55
Colors	lb.	.365 /	.60
6373	lb.	.345 /	.58
Colors	lb.	.395 /	.63
6461	lb.	.325 /	.56
Colors	lb.	.375 /	.61
8372	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8539, 8726	lb.	.33 /	.565
Colors	lb.	.35 /	.585
8590, 8591, 8592, 8593, 8594, 8595	lb.	2.00 /	2.75
8600	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8620	lb.	.27 /	.505
Colors	lb.	.32 /	.555
8630	lb.	.425 /	.66
Colors	lb.	.475 /	.71
8640	lb.	.35 /	.585
8650	lb.	.32 /	.555
8677	lb.	.435 /	.67
8700A, 8750	lb.	.425 /	.66
Colors	lb.	.455 /	.69
8720	lb.	.605 /	.84
8737	lb.	.33 /	.565
8740	lb.	.295 /	.53
8749	lb.	.29 /	.525
8800	lb.	.44 /	.675
8801	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8802	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8804	lb.	.29 /	.525
8807	lb.	.45 /	.685
8809	lb.	.37 /	.605
8810	lb.	.275 /	.55
8812, 8813, 8814, 8815	lb.	.315 /	.51
Geon Latex 151, 251	lb.	.26 /	.32
351	lb.	.32 /	.38
352	lb.	.28 /	.34
552, 652	lb.	.37 /	.43
450x167	lb.	.39 /	.45
576	lb.	.365 /	.405
Krene, film	lb.	.505 /	.655
Sheeting	lb.	.49 /	.645
Marvinols:			
NF-1005	lb.	.34 /	.625
NF-1055, 3520	lb.	.275 /	.56
NF-3020	lb.	.41 /	.645
NF-3025	lb.	.38 /	.665
NF-3040	lb.	.3375/	.6225
NF-3045, 3050	lb.	.37 /	.605
NF-3055	lb.	.285 /	.57
NF-3060	lb.	.29 /	.575
NF-3065	lb.	.30 /	.585
NF-3070, 3075, 3080		.265 /	.50
NF-3085, 3090, 3095	lb.	.29 /	.525
NF-3505, 3515	lb.	.36 /	.595
NF-3510	lb.	.34 /	.575
NF-4005	lb.	.44 /	.675
NF-4010, 4015, 4020	lb.	.42 /	.705
NF-5015, 5020	lb.	.40 /	.655
NF-5025	lb.	.33 /	.585
NF-5030	lb.	.29 /	.545
NR-6015	lb.	.39 /	.685
NR-6020	lb.	.39 /	.675
NR-7002, 7045, 7060	lb.	.50 /	.735
VR-10	lb.	.28 /	.47
VR-12, -20, -21, -22, -24, -30	lb.	.27 /	.46
VR-50	lb.	.30 /	.49
Opalon 300, 300FM	lb.	.31 /	.51
410	lb.	.34 /	.54
505	lb.	.35 /	.55
Inj. molding cmpds.	lb.	.29 /	.67
Profile extrusion cmpds.	lb.	.29 /	.72
Wire cmpds.	lb.	.29 /	.67
Plastiflex, std.	lb.	.90 /	1.10
Novelty	lb.	1.15 /	1.50
Pliovic AO (dispersion)	lb.	.30 /	.32
DB80V, DB90V, EDB90V	lb.	.27 /	.29
Latex 300	lb.	.30 /	.35
Reynolon, 4000 series	lb.	1.55 /	2.30
Rolls, 1-mil	sq. yd.	.0625/	.11
Colors	sq. yd.	.0675/	.08
4-mil	sq. yd.	.215 /	.3125
Colors	sq. yd.	.2375/	.255
16-mil	sq. yd.	.81 /	1.19
Colors	sq. yd.	.86 /	.945
Satinflex	lb.	1.15 /	1.50
Vygen 110, 120	lb.	.27 /	.31
1101, 1150	lb.	.425 /	.50
2201	lb.	.48 /	.55

Vinylidine

Dow Latex 744-B	lb.	.26 /	.42
Resin 565	lb.	.39 /	.525
Saran formulation 115, black, nat.	lb.	.39 /	.52
Colors	lb.	.44 /	.69
720 nat.	lb.	.41 /	.54
Colors	lb.	.46 /	.71
747 nat.	lb.	.395 /	.525
761 nat.	lb.	.39 /	.52
Colors	lb.	.44 /	.69
820 nat.	lb.	.42 /	.55
Colors	lb.	.47 /	.60
Latices	lb.	.45 /	.61
Resin F 120	lb.	.58 /	.65
F242	lb.	.64 /	.70

Solvents

Enjay acetone	lb.	$0.085 /	$0.12
Ethyl ester	gal.	.44	
Isopropyl acetate	lb.	.115 /	.15
Isopropyl alcohol 91%	gal.	.37 /	.60
95%	gal.	.39 /	.62
Anhydrous	gal.	.41 /	.64
Isopropyl ether	gal.	.30 /	.51
Methyl ethyl ketone	lb.	.125 /	.16
Secondary butyl acetate	lb.	.1225/	.1575
Secondary butyl alcohol	lb.	.125 /	.16

Stabilizers

Advastab B-13-P, BC-105, BC-147	lb.	.75 /	.80
BC-12, C-77, C-79, E-82	lb.	.90 /	.95
BC-74, BC-30	lb.	.70 /	.75
BZ-51, L paste, Z-6, Z-15	lb.	.65 /	.70
BZ-155	lb.	.69 /	.74
C-21	lb.	1.00 /	1.05
CH-101, CH-201	lb.	.60 /	.65
CZ-11	lb.	.95 /	1.00
E-98	lb.	.53 /	.58
JCX	lb.	.62 /	.67
SN	lb.	.47 /	.52
T-10, T-52	lb.	1.90 /	1.95
T-17M	lb.	2.95 /	3.00
T-50LT	lb.	3.20 /	3.25
T-52N	lb.	1.80 /	1.85
T-72, T-671	lb.	2.65 /	2.70
Argus Mark C	lb.	.88 /	.95
E	lb.	.72 /	.85
M	lb.	.68 /	.74
PL	lb.	.63 /	.69
TT	lb.	.72 /	.86
WS	lb.	.98 /	1.11
X	lb.	2.50 /	2.75
XI	lb.	.87 /	1.01
XV	lb.	.92 /	.99
XX	lb.	.58 /	.65
Barca 10	lb.	.75 /	.80
Baker barium ricinoleate	lb.	.70	
Calcium ricinoleate	lb.	.55	
Zinc ricinoleate	lb.	.60	
Dutch Boy Barinac	lb.	.70	
Calstar	lb.	.37	
Clarite A	lb.	.83	
B	lb.	.68	
CS-137	lb.	1.25	
DS-207	lb.	.55	
Dyphos	lb.	.58 /	.595
50A	lb.	.34	
Dythal	lb.	.395 /	41
Leadstar	lb.	.39	
Lectro 60	lb.	.2525	
Normal lead maleate	lb.	.4475	
Normasal	lb.	.46	
Pearlescent pigment	lb.	1.00	
Plumb-O-Sil-A	lb.	.3075	
-B	lb.	.325 /	.37
-C	lb.	.3475/	.375
Provinite A	lb.	.83	
B	lb.	.68	
Tribase	lb.	.275	
-E	lb.	.2225	
Trimal	lb.	.435	
Ferro 182	lb.	.70 /	.76
200	lb.	1.31 /	1.43
203, 900, 1820	lb.	.88 /	1.00
503	lb.	.28 /	.40
541A	lb.	.80 /	.92
700	lb.	.47 /	.59
703, 1972	lb.	.63 /	.75
823	lb.	2.50 /	2.75
840	lb.	3.25	
903	lb.	.58 /	.70
909	lb.	.91 /	1.01
1203	lb.	1.30 /	1.40
1206	lb.	1.23 /	1.33
1212	lb.	.68 /	.80
1825	lb.	.98 /	1.10
1840	lb.	.73 /	.85
1976	lb.	.45 /	.57
Harshaw 1-V-3	lb.	.43 /	.45
1-V-4	lb.	.665 /	.70
1-V-7, 1-V-26	lb.	.66 /	.68
2-V-4	lb.	.85 /	.87
2-V-5	lb.	1.09 /	1.12
5-V-1	lb.	.41 /	.43
7-V-2	lb.	.93 /	.95
8-V-1	lb.	.88 /	.90
8-V-21	lb.	.63 /	.65
8-V-100, 10-V-442	lb.	.82 /	.84
9-V-1	lb.	.70 /	.72
12-V-5	lb.	.73 /	.75
12-V-6	lb.	.92 /	.94
12-V-63	lb.	.72 /	.74
12-V-64	lb.	.68 /	.70
19-V-1	lb.	.52 /	.54
24-V-1	lb.	1.10 /	1.12
128-V-5	lb.	.86 /	.88
Merix AST Concentrate 1001	lb.	.355 /	1.75
Metasap 613-A	lb.	.69	
613-B	lb.	.84	
613-C	lb.	1.06	
621	lb.	.88	
624	lb.	.75	
Cadmium stearate	lb.	1.40 /	1.44
Fused stearates, calcium 602-A	lb.	.25 /	.30
Dibasic lead stearate	lb.	.56	
Lead 611	lb.	.32 /	.37
Lead stearate	lb.	.39 /	.44

Nuostable V-1	lb.	$0.54	/ $0.59
V-2	lb.	.39	/ .44
V-10	lb.	.70	/ .75
V-20	lb.	1.30	/ 1.35
V-21	lb.	1.29	/ 1.34
V-30	lb.	.90	/ .95
V-31	lb.	.80	/ .85
V-40	lb.	1.18	/ 1.23
V-42	lb.	.65	/ .70
V-43	lb.	.75	/ .80
V-44	lb.	.90	/ .95
V-45	lb.	1.10	/ 1.15
V-50	lb.	.49	/ .54
V-60	lb.	.37	/ .42
V-70	lb.	.68	/ .73
V-80	lb.	2.80	/ 2.85
V-81	lb.	2.90	/ 2.95
Permyl A	lb.	.45	/ .57
Stabelan 110, 120	lb.	.65	/ .75
115, HR paste	lb.	$0.85	/ $0.95
E	lb.	1.35	/ 1.50
HR-50	lb.	.75	/ .90
HR liquid	lb.	.65	/ .75
Powder	lb.	.95	/ 1.05
XL	lb.	.55	/ .65
Staflex QMXA	lb.	.70	
50% in DOP	lb.	.52	
OY	lb.	1.00	/ 1.20
Stayrite #10	lb.	.33	/ .37
#15	lb.	.54	/ .57
#20	lb.	.38	/ .42
#22	lb.	1.32	/ 1.34
#25	lb.	.36	/ .40
#70, 75, 80, 90	lb.	.69	/ .70
#229	lb.	.47	/ .50
P-10	lb.	.40	/ .44
Thermolite 12	lb.	2.00	/ 2.25
13	lb.	3.10	/ 3.78
15	lb.	$4.13	
17	lb.	2.45	/ 2.75
20	lb.	2.95	/ 3.25
39	lb.	2.75	/ 3.25
91	lb.	3.00	
Vanstay C-73 S.	lb.	.63	/ .65
HT	lb.	.90	/ .92
L	lb.	.33	/ .35
LN	lb.	.98	/ 1.00
R	lb.	.70	/ .72
Z	lb.	.67	/ .69

Wetting Agents

Advawet 212	lb.	.45	/ .50
Merix Wash Concentrate	lb.	2.59	/ 3.69
Poly-lube No. 4	gl.	1.45	/ 1.94